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JOURNEYS IN TIBET, 1906–1908.*

I. GENERAL NARRATIVE.

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Every one acquainted with the map of Tibet will think this map (p. 516) an extraordinary one, as it is not like even the very latest maps published in Europe. We are accustomed to regard Tibet as an enormous plateauland situated between the two highest mountain systems on the earth's surface, Kwen-lun and Himalaya, and from the comparatively level surface of this plateau we are accustomed to think mountains rise as groups or islands, or as small short ranges. Only the Kwen-lun ranges, Arka-tagh, the eastern part of the Koko-shilis, and Tang-la, and some of the ranges situated between the upper courses of the Indo-Chinese rivers were really drawn on the maps as uninterrupted ranges; and the same was of course the case with those parts of West Tibet which have been surveyed by the Survey of India, and where the Karakorum is the most magnificent of all. But for the rest of Tibet, the interior of this the most enormous protuberance or upheaval of the Earth's crust, our maps have hitherto been uncertain, and in vain we have tried to find any kind of orographical order or plausible systematic arrangement of the mountains.

However, if one uses and compares critically all the material that has been brought home by the few explorers who have crossed the interior of this mysterious country, one will easily find that even if the different routes are far apart, they are anyhow sufficient for drawing the most important conclusions. On my journey, 1899–1902, when I crossed Eastern Tibet on three different meridional lines, I had an

* Read at the Royal Geographical Society (Queen's Hall), February 8, 1909. Map, p. 516.

excellent opportunity to examine the situation and east-west direction of a whole series of ranges from the country of Lop in the north to 31½° N. in the south, and I indicated them on a general map. Farthest north we have the Ustun-tagh, the boundary range of the Kwen-lun sloping down to the basin of Eastern Turkestan, and south of it several other ranges belonging to the same system, and spreading out like the fingers of a hand to the east—for instance, Akato-tagh, Yilve-chimen, Piaslik-tagh, Chimen-tagh, etc. Then follows the highest range of the Kwen-lun system—Arka-tagh. South of Arka-tagh is an enormous latitudinal valley, and south of it is the range of Koko-shili, or "the green hills," so called by the Tajinur-mongols of Tsaidam. Then my three routes cross a range which is the western continuation of the Mongolian Dungbure, and south of it I crossed, again three times, the range which, further east, is called Buka-mangna, or "the wild yak's head," by the Mongolian pilgrims going to Lhasa. Only once I crossed in a very high double pass the gigantic range Tang-la, which was made famous some sixty-three years ago by Abbé Huc's journey; and finally, south of Tang-la, I crossed a whole series of smaller ranges stretching east and west, the southernmost of them situated on the southern shore of Selling-tso and Naktsang-tso, or Tso-ngombo.

Now, I have only mentioned the most important ranges. They are separated from each other by very broad latitudinal valleys; but in those valleys, which it takes often three days to cross, there are innumerable small ranges, which it is almost impossible to follow, as they are generally interrupted, and in some cases simply to be regarded as ramifications from the high ranges.

Some one may ask: Well, you know the orographical arrangement and the parallelism of the ranges in *this* part of Tibet, but how do you know that the same laws prevail to the east and west through the whole country? Then I will reply that on my journey of 1896 I went for two months straight east, with Arka-tagh on my left and Koko-shili on my right, without crossing a single pass until I turned north-east, crossing Arka-tagh in the Mongolian pass of Yike-tsohan-daban. Further, we have Wellby's and Malcolm's journey of the same year, 1896, through the whole of Northern Tibet from Ladak to the upper part of the northern branch of Yang-tse-kiang, Napchitaï-ulan-muren, the source of which they discovered. On the whole of this great journey through Northern Tibet they had the Koko-shili range on their left and Dungbure on their right, and had not to cross a single pass worth mentioning until they turned north-east and went over the Koko-shili. Those two routes are a very important control to the fact that the mountain ranges of Changtang stretch uninterruptedly west to east.

Between my routes of 1900 we have the route of Bonvalot and Prince Henry of Orléans of 1889, and they crossed the same ranges as I, but by other passes. To the east the information given by the

Lazarist fathers, Huc and Gabet, 1845, by General Prjevalsky on his several famous journeys from 1870 to 1885, and by Rockhill's fine journey of 1892, is quite sufficient to make it possible to follow the ranges far to the east, the Koko-shili being called Bayankhara-ula, south of the source of Hwang-ho, the Dungbure stretching between Yang-tse-kiang and the northern Mekong branch, the Bukamangna between the two Mekong branches, the Tang-la being a watershed between Mekong and Salwen.

As to the country to the west the material existing seems also to be sufficient for reliable conclusions. Here we have first Littledale on his audacious journey, 1894–5, and west of him Dutreuil de Rhins and Grenard, 1893, their map being one of the best ever made in Tibet. Then follows a great gap, the greatest unexplored patch still left in Tibet, and then my route of 1906, on which I crossed the western continuation of the two ranges I knew before, and which had been crossed, as stated, by Littledale and de Rhins. One step further west we have Bower's journey of 1891, and then the several routes of Deasy, 1898, and Rawling, 1903, both equally important and both giving us the most accurate and excellent maps of Western Tibet, as I have been able to prove more than once. Between their many routes up and down is my last journey of 1908, when I, as far as to Lemchung-tso, had very little to add to their thorough exploration, and when I crossed for the sixth time this enormous range, being the western continuation of Tang-la, and nothing else than the eastern continuation of Karakorum. As to the westernmost part of the Karakorum-Tang-la range, it has of course been crossed by I do not know how many explorers—Adolf Schlagintweit, who was, I believe, the first European to reach Eastern Turkestan from India in 1857, and murdered in Kashgar; Johnson, the first British explorer to Khotan, 1865; Hayward, murdered on his way; Shaw; Dalgleish, murdered on the Karakorum pass; Younghusband several times, more especially on his famous journey over the Mus-tagh pass, and many many others. I crossed the Karakorum pass in 1902, and then, in 1906, a pass situated a little to the east of Chang-lung-yogma, which was taken by the Forsyth Embassy to Yakub Beg of Kashgar in 1873, information which I got from old Guffaru, one of my servants, who had followed Forsyth to Kashgar and seen the great Yakub Beg in all his pomp and state. Lanek-la is also a Karakorum pass, and has been crossed by several explorers, all British.

When going from India to Eastern Turkestan one crosses north of the Karakorum range two very considerable ranges—the Suget range in Suget-davan, a continuation of Koko-shili, and the Sandshu range in Sandshu-davan, the continuation of Arka-tagh. The Dungbure and Buka-mangna die away to the west before they have reached so far. Far West, in countries under British rule, it is easy to study the

parallelism of the mountain ranges by help of the admirable maps of the Survey of India. A country with this strictly parallel arrangement of the ranges is called in German a "Faltenland," and a mountain system with the same orographical architecture a "Faltengebirge," and Tibet is the greatest Faltenland of the earth, although Persia is also a beautiful example of the same structure.

It is, of course, impossible to give a sufficient description of the physical geography of such a great country as Tibet in one or two hours, Tibet being four times as big as France. I will only mention that between the several ranges stretching through the whole of Chang-tang, there are latitudinal valleys, and that every one of them is divided into a great number of self-contained basins, *i.e.* without outlet to the ocean, or even to Eastern Turkestan or Tsaidam. In the bottom of almost every such depression is a salt lake, where the rock salt, carried down by small brooks, has accumulated for thousands of years. As a rule, the ground of the latitudinal valleys is very level; as I said, Wellby had almost no passes to cross on his long journey through Tibet, but going from north to south I had a lot of passes to wander over.

Many different agencies are working constantly to level out the country. The capillary frost forces the hardest rocks to burst and fall into pieces; the finer material, dust and sand, is carried away by the wind and contributes to fill out some depression; greater material is brought down by the brooks and the rain water, and the result is that the ranges are growing lower and lower, the depressions higher and higher, and the relative altitudes diminish in the course of innumerable centuries. If one has seen the Sachu-tsanpo in the rainy season, dark grey with mud and silt brought down to Selling-tso, or a spring storm with the air absolutely full of sand and dust, one will easily realize the enormous work carried out by wind and water in the transportation of solid material. Once Northern Tibet was no doubt as accentuated as the Himalaya—it is the work of the atmospheric influences of geological periods that has given the country its present relief. Solid material has filled up all deep valleys and depressions, and denudation and transportation are still going on, and what we call a plateauland is a perfectly secondary phenomenon. Here the horizontal lines prevail, specially in Central Tibet; one has to go down to peripheral country to find vertical lines in the landscape. My panoramas will show how very level the land is as a whole, in the same way as the ocean seen from a ship's deck, even if the waves are as high as they possibly can be. The whole of Tibet is like a sea, the gigantic waves of which, driven up by northern or southern winds, have been changed into stone at the moment of their worst fury. On the ocean every ninth wave is said to be higher than the rest—in Tibet the case is the same; after a certain interval one comes to a mountain wave much higher than the neighbours. It is the

tangential pressure in the Earth's crust that has forced those ranges to rise, and as the pressure has been stronger in the west, the ranges are here situated much closer to each other than in the east. They diverge from the enormous mountain knot of the Pamirs, and the distance between them becomes greater and greater to the east.

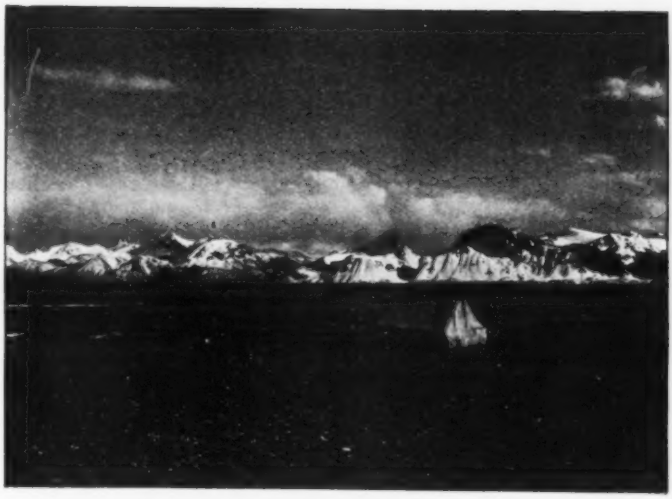
Time does not allow me now to enter upon the interesting question of a probable Ice-Age in Tibet, the curious distribution of the lakes, most of them being situated near the highest mountains, nor can I give now an account of the general meteorological and climatological relations—as I know them—the prevailing west and south-west wind being the most conspicuous and characteristic element. I will only say that, so far as my experience goes, it rains more in the east than in the west, but snows more in the west than in the east—that is to say, that Eastern Tibet gets most of its precipitation in summer, Western Tibet in winter. The fluctuation of the water stored in lakes and rivers depends of course upon the precipitation, and as this is diminishing all lakes are slowly drying up, although this may be only a periodical phenomenon. The abundance of grass depends also upon the rain, and as the prosperity of the flocks depends upon the grass, and the existence of the nomads, nay, the whole country, depends upon the flocks, everybody is looking out for rain, specially in July and August, which is the rainy season.

Of great interest it will be to draw on a map the boundaries of all the self-contained basins we know; they form a very curious mosaic on the plateauland, and their exterior boundary is the chief watershed of Tibet, in which the greatest rivers of Asia, except the Siberian and Aral rivers, rise. As to the heights, the data we possess are now so numerous, that it will not be difficult to make a general hypsometric map with the regions of different height in different shades of brown. The map illustrating this lecture gives only a vague idea of the general orographical structure. From 1200 different places on this journey I have taken specimens of rock with dip and fall, and from these a general geological map and geological profiles may be constructed. Every one of those sciences would give material enough for a separate lecture, and there is enough to do in Tibet for the explorers of the future, even if the period of important geographical discoveries is past.

But now to my journey. The red line is my journey of 1906–1908. It looks so nice and comfortable on the map, but in reality it is a very serious and difficult thing to cross the whole of Tibet from north to south. I left Leh on August 12, 1906, with the strongest caravan I have ever had: twenty-five Ladakis, ninety-seven ponies and mules, and thirty ponies hired for the first month. Of the animals only six came through. Dr. Arthur Neve had recommended to me a young Babu, Robert, who proved to be a very excellent help in several scientific observations and a favourite with both Ladakis, Tibetans, and myself. My noble friend

of so many Asiatic years, Sir Francis Younghusband, had been kind enough to provide me with the very best caravan-bashi that could be got, Mohamed Isa, who had been with Younghusband to Mus-tagh and Lhasa, and was Ryder's and Rawling's caravan leader; he was at the side of de Rhins when he was murdered in Eastern Tibet, 1894, and he had an experience of thirty years of Asiatic travel. I shall never forget the great kindness with which H.H. The Maharaja of Kashmir, his private secretary, Daya Kishen Kaul, and, in Leh, Captain Patterson, helped me in every possible way to get together a really first-class caravan.

We went north-east over Marsimik-la, crossed the Karakorum east of Chang-lung-yogma, crossed Ling-shi-tang and Aksai-chin, crossed Deasy's, Rawling's, and Wellby's routes, kept east and east-north-east, and turned south-east between the routes of Bower and de Rhins. On the heights of the Buka-mangna range we lost nine mules in one day, but to the south the country became more and more hospitable, with plenty of grass and water. After eighty-three days' loneliness we found the first nomads, and then we passed black tents almost every day, and could buy yaks to replace our dead animals. We left to the east the lake which de Rhins calls Ammoniac lake, continued straight south to Bog-tsang-tsangpo, which I followed a couple of days to get a connection with my map of 1901, turned again south-east, crossing two considerable ranges; from one of them just a little bit of Dangra-yum-tso could be seen to the south. We reached Ngangtse-tso on December 28, and here appeared my old friend, Hladje Tsering, with a little escort to stop me. The first day he told me I could never proceed in this direction—I had to leave Naktsang territory at once and go north or west; but the next day he gave me permission to continue towards Shigatse. I have never been able to understand why Hladje Tsering changed his mind, but I have heard that this cost him his place and rank. Perhaps it was wrong of me to expose him to such a great risk, but I believed he had got some secret order during his stay in my camp, and he probably believed I had got some private permission to visit Shigatse. Moreover, my geographical morals are quite different to my ordinary morals, and if I can possibly make any geographical discoveries—I go on. And on we went south-east, crossing six passes. I really do not know why I hurried on this time much quicker than usual, without stopping anywhere and making very long marches. It was as if some invisible force had pushed me on, and even when we reached Ye-shung, on the northern bank of the Tsangpo, where several great gunpas were a strong temptation to visit, I did not stop, but hurried on to Shigatse, and entered the city late in the evening of February 9, 1907. On the 11th, in the morning, arrived one lama and one official from Devashung; they told me news had reached Lhasa from Hladje Tsering, and at once they were sent with a little force to Ngangtse-tso to stop me and force



MOUNTAIN RANGE IN NORTH-EAST TIBET.

MOUNTAIN SCENERY, NORTH-WEST TIBET.

me to return. And when they heard I was gone, they hurried on in my steps and reached Shigatse a day and a half after me. If I had travelled just a little slower I should never have reached the town, never seen Tashi-lunpo and the Tashi Lama.

The most important geographical discoveries on this line from Ngangtse-tso to Shigatse were the very high mountain sytems we crossed in Se-la, and south of it the complicated river system of My-chu, which joins Raga-tsangpo one day above its junction with the Tsangpo, and is one of the greatest northern tributaries to the upper Brahmaputra. When I stood on Se-la, and in a biting January gale sketched a panorama of the whole horizon, and later on after having crossed this complicated world of enormous mountains and this labyrinth of deep wild valleys, I understood that this range could not possibly be anything else but the western continuation of the mighty range which is situated on the southern shore of Nam-tso or Tengri-nor, the highest known summit of which is Nien-chen-tang-la. So when I wrote to Major O'Connor I proposed to call the whole range Nien-chen-tang-la.

The eastern part of this range was for several years fairly well known. It was known to be a watershed between the Salwen and Brahmaputra. The famous pundit, A.K., had crossed it in 1881, probably in Nub-kong-la. Abbé Huc and Abbé Gabet had crossed it in 1845 in Shang-shung-la, which again had been taken by A.K., and which for centuries has been crossed by innumerable Mongolian pilgrims with the same feelings of exaltation as the Mohammedan pilgrims pass Mount Arafat on their way to Mecca.

Further one step westward we have the pass Dam-largen-la crossed by the admirable and noble pundit, Nain Singh, in 1874, and just west of Nien-chen-tang-la there is Guring-la, crossed by Littledale on his memorable journey, 1894–95, when he was forced to return the same way. Guring-la and Dam-largen-la are important from a religious point of view. Many pilgrims every year wander round Nam-tso, and some of them include Nien-chen-tang-la in the ring, thereby walking over the two passes. Several gunpas are situated on the shore of this the greatest lake of Tibet. Three journeys round the lake absolve the pilgrim from all his sins and make him sure of a happier existence when he will be next re-born. Then follow Tsebo-la and Shugu-la, of which I have got only verbal information, and finally the last hitherto known pass to the west, Kalamba-la, crossed by Nain Singh in 1872. So far the geographical and orographical situation of this range was known before, when I crossed Se-la and could thus draw the range some 100 miles further to the west. I suspected already that this range continues far, far to the west-north-west, and Major O'Connor told me in a letter from Gyantse that he had long suspected the same thing, partly from the reports of pundits and partly from verbal information he had got in Tibet, and he proved to be perfectly right.

But what did we really *know?* Nothing, or next to nothing! Did the geographical literature of any time or any country contain a word about this range except some meagre hypothesis? No, nothing! Nain Singh had followed the Brahmaputra valley up in 1865, and so did Ryder and Rawling, Wood and Bailey, on their journey to Gartok, which has given to geographical science the best and most accurate map that ever has been made in Tibet. But from their route in the Tsangpo valley the head range cannot be seen from a single point, as I found afterwards by my own experience. One sees several gangris, or mounts, with eternal snow and ice, but one does not see the head range, or rather watershed, itself, and one has not the slightest idea of the very complicated architecture further north. Verbal information will lead to nothing, as I found. I asked people, especially merchants, who had been up to the north for years every year, and got them to tell where they camped, where they went over passes, where lakes and rivers were situated; but when I tried to get some certain conclusion the result proved to be hopeless confusion. I do not know what Major Ryder believed of the country to the north; probably he believed it was a high plateau-land, the highest ridge or range of which was situated about 31° N. lat., and where Chachu and Charta-tsangpo had their sources. The southern boundary of this plateau-land he probably thought was formed by a border range, several peaks of which he measured, and which he regarded as broken through in transverse valleys by the two considerable rivers mentioned above. I believed, as I have explained in the fourth volume of my last scientific work, that it was a highland with two ranges parallel with the Tsangpo, and I had arrived at this conclusion from Nain Singh's lakes, those which he had heard of but not seen; but it all proved to be perfectly wrong. How little we really knew of the country—"the Dokthol Province," a name absolutely unknown to the natives—is shown also by a letter I got from Captain Rawling, in which he expresses the theory that the great northern tributaries of the Tsangpo come from the Central Lakes, discovered by Nain Singh, and exactly the same theory is found in Sir Thomas Holdich's excellent book, 'Tibet the Mysterious,' which was published after Ryder's and Rawling's expedition. So all of us who had specially paid attention to this problem, knew absolutely nothing of the country, and we lost ourselves in hypotheses of very little value, as they had no real foundation.

But first let us leave Shigatse. I stayed six weeks there, or rather in Tashi-lunpo, where I spent the whole time. The Tashi-lama, or Panchen Rinpoche (Banchin Bogdo, as he is called by the Mongolians), is one of the most remarkable and fascinating men I have met in my life, and I shall never forget the great hospitality and kindness he showed me as long as I was his guest. I arrived just at the Losar, or New Year's festivals, and was invited to every day's play.

ONE OF OUR CAMPS, CENTRAL TIBET.

MOHAMED ISA AND TWO LADAKI CHIEFS.

How very wonderful and picturesque it all was. The Losar hymns of Tashi-lunpo made a deeper impression upon me than even the Church music in Kasansky Sobor in Petersburg, or Uspensky Sobor in Moscow. They are full of faith and longing, of mysticism and harmony, and they lead the listener away to the land of dreams and hope. To begin with, they go in crescendo and then in diminuendo as far, far away as if the singers were already at the gates of Nirvana.

During my stay in Shigatse I made acquaintance with another man whom I shall never forget, Major O'Connor, although I never met him personally; but we were in very lively correspondence, and he gave me any amount of valuable information and advice. The Chinese High Commissioner, Thang Darin, and the Amban of Lhasa, Lien Darin, were extremely polite and kind in their letters to me; they probably wished me to go to Gyantse, as it would be easier to get me down to India from there. But I did not go to Gyantse at all. The Tibetan authorities of Lhasa seemed not to know at all what to do with me. They have hardly made acquaintance with anybody who has been so difficult to get rid of as me—except Younghusband, of course. One day in Shigatse I got three big boxes from Major O'Connor. They contained a whole library of books and all sorts of most delicious tins, cakes, biscuits, wine, liquors, and champagne. Imagine me drinking champagne quite alone in my tent in Tibet. Every day in Shigatse I proposed O'Connor's health at my lonely dinner.

As to the ambassadors from Lhasa, who had to deal with me as to which way to return, I would not tell them openly that my wish was to take some northern road where I could study the great range of Nienchen-tang-la further to the west. I thought they would be suspicious, and stop me altogether. But I managed to get permission to take the Raga-tsangpo road, and from there the escort took me up over the head range again, which I crossed in the pass Chang-la-Pod-la, and thus I got some 50 miles more of the western continuation of the range.

Now it was my intention to go to Dangra-yum-tso, discovered by Nain Singh, and by help of some rupees the escort agreed to take me down there. As I have said, my geographical morals are a funny sort of thing, but well—they give me their lakes and mountains, and I give them my rupees, and both parties are extremely pleased and satisfied with each other; but for them, of course, it is a risk. Now this time, when we were two short marches from the lake, and it could be seen in the north as a thin blue line, I was stopped by a force from Shansa dsong and made to go down to Raga-tasam. But I had fixed the situation of Targo-gangri, Targo-tsangpo, and Sershik-gumpa, all three heard of but not visited by Nain Singh. And I had discovered Shuru-tso, a rather big lake at the very northern foot of the head range. And now I crossed this range again in Angden-la, continuing it some 60 miles

further west. In Raga-tasam I touched Ryder's and Rawling's route for the first time since Shigatse.

Dangra-yum-tso is much too big on Nain Singh's map, and his Mun-tso, two small lakes, are situated not south but west of southern Dangra-yum-tso. Both Targo-gangri, one of the most magnificent snow mountains with glaciers I have seen in Tibet, and Dangra-yum-tso (or Dangra, as it is usually called) are holy; it is exactly the same combination as Mansarowar and Kailas in the west, and Nam-tso and Nienchen-tang-la in the east. It takes the pilgrim five days to go round the lake; the water is slightly salt, but they drink it anyhow, as it is holy, and a man or a pony who has drunk of it will for ever be safe from wolves and robbers and sickness. At the eastern foot of Targo-gangri, one day south of the lake, is Sershik-gunpa, a comparatively rich temple-monastery. The lamas belong to the Pembo sect. I do not know exactly the difference between the Pembos and the orthodox, but when the orthodox say, "On mane padme hum," the Pembos say, "On mate moti sale do," and they hate each other heartily. As the Greek Catholics make the sign of the cross from right to left, whereas the Roman Catholics do it from left to right, so the Pembos have the little funny peculiarity of turning their prayer-wheels the wrong way, and both, of course, believe the other will burn in eternal fire, or, at any rate, be re-born in a very poor and miserable form of existence.

From Raga we went to Saka-dsong, leaving the beautiful snow-massive of Chomo-uchong, or "The High Nun," to our left. In Saka Mohammed Isa died, and was buried strictly after the Mohammedan ritual. One year later some Tibetans told me that ghosts were haunting the grave every night, and from the interior of the grave one heard mysterious sounds and sighs, so nobody dared to come near it.

Several times I tried to get permission to go north to see more of the great range and the country north of the Tsangpo, but always in vain; once we tried to slip over, but were stopped by Bongba men. I wrote to Lien Darin and Thang Darin with special mail-runners. Lien replied, certainly I could take a northern road if I liked; but I got his letter three months too late. Thang said he could under no conditions let me go to the north-west, "as both people and country are wild there." I wonder how he knew that. It was really hard to go further and further west, and to leave more and more of the great unknown country to my right, because this patch north of the upper Brahmaputra was the greatest white patch in Asia, with only one exception, a part of the Arabian desert.

The Gova of Tradum, a great scoundrel, but one of my best friends in Tibet, let me go south over the Tibetan frontier and down into Nepal. The Himalayan watershed pass one crosses here * is only about 300 feet

* Kore-la.

A LAKE IN CENTRAL TIBET.

ON THE SHORE OF LAKE LIGHTEN.

above the Tsangpo, and it should be an easy matter for modern engineering to dig a channel and force the upper Brahmaputra to become a tributary to the Ganges, although I really do not know if northern India would become more happy for that; the Tibetans would be awfully angry, that is sure.

The next problem that interested me specially was to find the source of the Brahmaputra, and I have described in a short note how this trip was successfully carried out, so I will not take up time with it now. It was a proud feeling to stand at the three-headed source of the magnificent river that goes out in the ocean near Calcutta, Brahmas son, famous in the ancient history of India. But perhaps it was still more wonderful, some time later on, to camp over a night at the little rock from which the Indus comes out as an abundant spring, growing bigger and bigger on its adventurous way down through the mountains, singing its eternal songs between the rocks, the same melodies as in the Macedonian's time. I had a feeling as if the fate of my own life through this river in some little way got connected with his, although 2200 years lay between us and *sans comparaison*, of course. But all this, as well as the interesting question of the watershed between the Brahmaputra and the Sutlej, and how the Sutlej still, although underground, comes from Mansarovar and Rakas-tal; further, my adventurous navigation days and nights over those two lakes, my pilgrimage round the holy mount of Kailas or Kang Rinpoche, and my journey up to Yumba-matsen and down to Gartok—all this has to be left to my next book.

The two passes Lachen-la and Jukti-la, which I crossed on this trip, are situated in the very considerable range which stretches north-west to south-east, one day north of Mount Kailas, and which I was almost sure was the same range I had crossed in Se-la, Chang-la-Pod-la and Angden-la. Between Jukti-la and Lachen-la are Dopchen-la and Hle-la, and west of Jukti-la several easy passes—for instance, Pema-la. At Chang-la it has been crossed by innumerable explorers and hunters. The Indus follows the south-west foot of the range the whole way to Gilgit, and the range goes through Ladak, Baltistan, and Chitral, and seems to be in very near relationship with the Hindu-Kush, thus going through Afghanistan also. But here was the weak point: it had never been proved that this western range was uninterruptedly one and the same as the eastern one south of Tengri-nor, and when I had come so far, I would give my life to solve this beautiful problem, which might certainly be called the most important and magnificent geographical problem still left to be solved in Asia. But when I reached Gartok I was far from the definite solution. Between Angden-la and Lachen-la I had left a gap some 300 miles long, and of this gap I knew nothing, although I and Nain Singh were the single explorers who had gone round it. Only step by step should I be able to understand and to penetrate

into the very soul of this gigantic world of mountains. It takes time—of course it must take time to digest such an enormous lot of stone as this mountain system. It can be done only successively and with an angel's patience. Every new pass over the head range will make the complicated orography clearer and open new perspectives.

Well, when I arrived in Gartok I was sure I *could* not leave Tibet without having crossed the unknown country at least once. If I succeeded in this, it was my plan to reach India *viâ* Nepal. And so we began to try and demoralize the younger Garpun (the other was sick) in the most horrible way. The great Ladaki merchant, Gulam Razoul, to whom the Garpun is in debt for big sums, tried all possible ways to get permission for me to go eastwards into the unknown. He said that when our animals died we had been obliged to bury some precious boxes somewhere to the east, and had to go and fetch them now, which was, of course, a formidable lie, as we had not lost so much as a box of matches; but the Garpun replied that he did not care a bit for my lost boxes, and that it was more important for him not to lose his own head, which he was sure of if he let me go into the forbidden country. Then Gulam Razoul told him I should give him two thousand rupees if he let me go, but he answered dramatically: "If this house were of solid gold, and he gave it to me, I should not take it; if he tries to slip over to the east without permission, I will send armed men to catch him." So he was too strong for us, and I had to think over a quite different scheme.

I decided to go round again and to enter the Chang-tang from the north, and cross the whole of Tibet diagonally once more. I knew it was a matter of half a year to reach regions which were only one month from Gartok, and this half year was the winter. But now, of course, the Garpun was suspicious, so much the more as he saw me buy twenty-one Tibetan mules from Gulam Razoul.

From Gartok we sent couriers to Gulam Razoul's father in Leh, old Haji Naser Shah, to arrange a quite new complete caravan for me. He would even provide me with new men; not a single man of the first set should follow me, as they might have been recognized later on. When I reached Durguk, November 30, 1907, the new caravan had arrived the very same day, and everything was ready.

In Gartok I had told everybody that I was going to Khotan and Peking. Even Haji Naser Shah and the new eleven men believed this was the plan. I went so far as to send a telegram to Reuter about Khotan. It was quite necessary that nobody should suspect anything else, because Rudok-dsong has spies in Ladak, specially one in Durguk, and if he should have got the slightest suspicion about the real plan, we should have been stopped somewhere north of Rudok. My new caravan-bashi, Abdul Kerim, was a perfectly honest man, but the greatest ass I have ever met. I ordered him to take corn for the animals for three

CHANG-CHENMO.

SHIGATSE-DSONG.

months, but as he was sure we should go to Khotan he took corn only for twenty-one days. For the men, fortunately, he took five months' provisions as ordered. I had one little tent, the men two bigger. My luggage was reduced to a minimum, three boxes only; amongst their contents there were two complete Ladaki dresses, as it was my intention to travel in disguise as a Ladaki merchant as soon as we came across natives. Only three ponies, two mules and one dog were veterans from the first journey. Perhaps somebody might recognize them. Oh no, they were all dead long ago, when we met the first Tibetans. All the rest, men and forty animals, were new.

We left Durguk on December 4, and it was a hard journey that began now, the hardest I have ever made. We penetrated deeper and deeper into the heart of Asia, but also into the heart of a new winter, and a winter on those enormous altitudes. From Sheyok we took a man, who had to look after our twenty-six sheep; and as he was a new addition to the caravan we became thirteen—but we were not superstitious. We met several caravans from Yarkand. One of them was a perfect wreck, and had lost fifty-two ponies on the road. In one caravan I met my old servant, Mollah Shah, who was also with Littledale, and now he had not been to his home in Cherchen since he left me in 1902—what a wonderful life of wanderings and struggle they live, those Asiatics. Most of the Yarkandis advised me to wait till spring, as the Karakorum pass was very bad. The whole way is full of dead ponies. At one place, during two hours' ride, I reckoned sixty-three. Some of them looked as if they were taking a rest only, some were half-buried in snow; the dogs barked at them until they got accustomed to see them. At several places we passed heaps of boxes and big packets of silk left by caravans that had lost all their animals—it is like ships having to throw all their cargo overboard when they begin to sink. It is a real Via Dolorosa; those grey granite rocks could tell no end of sufferings they have witnessed; in the night one thinks one can hear the sighs and heavy breathing of an endless carnival of animals, the veterans not able to walk any further.

The Karakorum pass can never be improved—it is the absolute height that kills. But in the Sheyok valley, where the road crosses the half-frozen river twenty-five times, something could be done. It may be strategically wise to leave the bad boundary roads as they are; but trade with Eastern Turkestan suffers from it. In the Durguk valley a couple of dynamite cartridges would improve that horrible road immensely.

We passed a man who had been abandoned with both hands and feet frozen on the Karakorum; the fingers were literally falling off. He said he was creeping down to Sheyok. We gave him bread, flour, matches, and some rupees. In the nights the moonshine was brilliant, the mountains stood like black coffins on both sides of the valley, with

the blinding white snowfields over them. A lonely raven followed us for a month; I hate them; they only wait in case somebody may be left behind. But on December 16 the caravan got an addition—four puppies; two were drowned, one died the very day he opened his eyes to get a glimpse of this cold mysterious world; but the last one came with me to Simla.

At Burtse, where the cold went down to −35° C. (63° of frost Fahr.), I made the first discovery during this journey—only eight days' corn left. To return to get more had been to spoil the whole plan. I was quite prepared that all the animals should die, and we should have to go on foot as far as we could. Now just here a big valley from the east seemed to invite us; if we found a road here we should save several days. A man was sent up and reported that the way was excellent, so we went on and marched the whole long day to a point where the valley was so blocked that hardly a monkey would have been able to continue further. The country was absolutely sterile. In the night the animals were kept tied up; they ate two sacks and most of their ropes. So the next day we hurried down the same way; we had lost three precious days, all were tired, and the situation looked rather hopeless. Mohamed Isa's pony from Shigatse was the first to die; he looked tired and done for where he had fallen in the snow; he seemed to need a long, long rest. The raven at once pecked out his eyes. Now our sheep began to die of cold, height, and fatigue. On the evening of December 23, in the ravine Kisil-unkur, the men, eight of whom were Mohammedans, began to sing a rhythmic and melodious hymn to Allah, praying him to let us cross the Dapsang without a snowstorm. And still nobody knew my real plan. So they were rather astonished when I, the next day, gave orders on the heights of Dapsang to turn straight east. We left the Karakorum pass to the north, went over the range by another pass, and the whole day we ploughed a track through deep snow. The night came down over the enormous snowfields, biting cold; the temperature went down to the freezing point of mercury (−38°·6 C., 69½° of frost Fahr.). I had two candles and a nice fire in my tent, as it was Christmas Eve. The next morning one pony lay dead and hard on his place amongst the rest.

And now our difficulties began. The Mohammedans were constantly singing prayers to Allah, with their eternal "Allahu Ekber" and "Allhamdulillah rabel alahmin errahman errahim." I understood they were afraid and regarding the situation as specially serious. The ordinary profane songs of Ladak had long ago frozen away on their lips. Over comparatively open land we kept east. No grass at all, but where burtse and yapchan plants grew we used to camp. Not a drop of water; the animals had to eat snow. The corn was finished, and rice and flour from the men's provisions given to the animals—we only took care that a supply for fifty days should be kept aside.

In the beginning of January we lost ourselves in a labyrinth of

mountains, passes, and deep valleys, all belonging to the Upper Kara-kash-darya, going down to Eastern Turkestan. On January 11 we camped at the very same point as last year, on the shore of the Aksai-chin lake. It was like a funeral procession; every day took a mule or a pony, sometimes two. All boxes, books that were read, and other unnecessary things were used as firewood. In the night of January 15 the cold was −39°·8 C. (71°·6 of frost Fahr.), the lowest I have ever read. During the periods of intense continental winter cold we had fortunately no wind to talk of. *Ovis Ammon* and Orongo antelopes were numerous now, and once our hunter killed two, and the two last sheep were spared for a time. On January 18 we had lost one-fourth of the caravan; the next day we found the first signs of Tibetan hunters, and on the 20th a hard storm killed two animals, one of which was the last mule I had bought from the Rajah of Poonsh. Now began a storm that went on for weeks without interruption and killed all our weaker animals On January 26 we crossed Arport-tso on the ice, which was covered with snow, green and clear as glass. Two days later we lost three animals, and the last sheep was killed.

On the following days heaps of snow came down; we proceeded hopelessly slowly through 2 feet of snow, sometimes 3. Nothing could be seen; the first ponies and mules in the caravan disappeared as phantoms in the snow-drifts. At the western end of Shemen-tso I thought we should be snowed up for the rest of the winter. It snowed day and night; walls of snow gathered round the tents; it was more like a Polar expedition. The storm continued as before. We followed the northern shore of Shemen-tso. On February 5 sixteen animals out of forty were left. Once more everything that could be spared was burnt. We had no meat left, and almost all rice was given to the last animals; it was necessary to make the loads lighter. The next day one mule and one pony died.

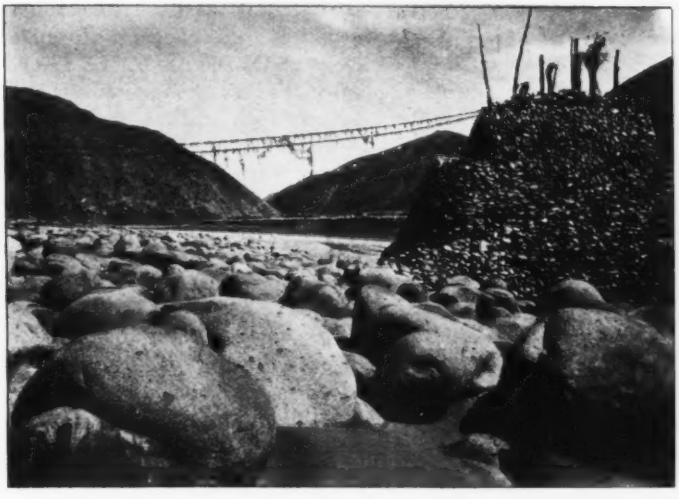
On February 8 we passed a trap with an Orongo antelope in it, and all were happy to get meat. Of course this was a sign that hunters were near, and later in the day we found two tents, and could buy a couple of sheep, milk, and butter. During sixty-seven days we had not seen a man. Now all my European clothes were burnt, and I appeared in disguise quite like the other Ladakis. On February 15 we crossed the Karakorum range again, which killed three of our animals, amongst them my riding pony, which had carried me faithfully through so many adventures for one and a half years, and saved me when once a wild yak was very near to take both him and me on his horns. It was more hard than I can tell to lose him. On the other side we passed some gold-mines. And so we left Deasy's and Rawling's routes behind us, passed Lemchung-tso, always in storm, and entered new country. Again, since a couple of animals had died, several things were burnt or thrown into Lemchung-tso, even some thermometers, clothes, boots,

belts, etc. February 24 we had still three ponies and seven mules, one-fourth of the caravan, left. Two days later great goldfields again. The 29th we reached Lumburringmo-tso, where the Senkor nomads said that never had any Ladaki merchants passed through Chang-tang, least of all in winter, and that we had a European hidden amongst us. We stayed two days with them, got friends, and bought twelve sheep for loads. For several days the storm was so hard that it was impossible to move.

On March 7 we camped on the bank of a river going south-west and frozen all over. One mule died, and the two dogs stayed with her to get a nice meal—they were never heard of afterwards. The storm made it impossible for them to follow our footsteps. As one of them was my special favourite since Srinagar, I felt quite lonely in my tent since she was gone. Now we had only the three-months'-old puppy left. During the five journeys I have made in Asia, the first in 1885-86, I have had hundreds of servants, and I have forgot many of them. But I have not forgotten a single one of the dogs; they stand before my memory as clear and alive as if I had left them yesterday. And it is always more difficult to say good-bye to the dogs than to the men; the men go home to their friends and families and will be quite happy, but the dogs *have* no home and nobody to go to, and nobody will be kind to them afterwards, and when I leave them they look after me with long wondering melancholy eyes, and I cannot possibly take them all home with me; I should have a real exhibition of Asiatic dogs by this if I did. Once I took a dog from Lop the whole way to Peking, through Mongolia and Siberia to Petersburg; but as it was forbidden by that time to take dogs over from Russia into Sweden, I had to give him to a friend in Pulkova. But there he almost killed half a dozen old women and every cat within a radius of three miles. So my friend gave him to a peasant, with whom, I suppose, he continued his wild Asiatic robber life.

And so we reached the district of Nagrong, with two stone houses and a big temple tent belonging to the Gertse Pun. From here the ground was excellent, an open latitudinal valley, but there was still much snow, and the storm went on. March 16 we camped on the shore of Tong-tso, and now we passed tents everywhere and could buy sheep and a couple of yaks. I had to paint my face and hands black every morning, but I could never get so dirty as the Ladakis. So we turned south, leaving the beautiful gangri Shakangsham to the east, crossed two small passes, and heard of Karma Puntso, the Governor of Bongba—it was critical to be so near to him. Once we bought a pony and a big dog, Takkar, wild as a wolf; he soon became our friend and favourite, and was quite mad with fury at every Tibetan he saw. The following days we went through a real labyrinth of mountains stretching east to west, crossed Kangsham-tsangpo, Chaklam-la,

THE BROTHER AND SISTER-IN-LAW OF THE TASHI-LAMA.



THE BRIDGE OVER THE TSANGPO NEAR PUN-TSO-LING.

Sangchen-chu, Sangchen-la and Ladung-la. Our caravan consisted now of two ponies, three mules, two yaks, and twenty-five sheep, all under loads. And so we met the great merchant, Tsongpun Tashi, who stays here over the winter selling tea to the nomads on credit; in the summer, when they have sold their sheep wool, they pay their debts. He came to pay us a visit, and as he seemed very interested in our tents and their contents, Abdul Kerim cried to Kutus, one of my Ladakis, and Haji Baba (that was me) to go and catch a pony that had run away in the mountains. Tsongpun Tashi is a powerful man from Lhasa, and it was nice to come away from him without any further adventures. In three days we passed thirty-two tents, and I had to go on foot and drive the sheep. On April 1 we crossed Satsot-la and came down to Chunit-tso, and followed its western shore for one day; here we met a great salt caravan from Tabie-tsaka, from which most of central and eastern Tibet get their supply of salt. Always keeping straight south we went over Nima-lung-la and reached the district of Kemar with several tent villages.

One of the mighty head ranges north of the upper Brahmaputra is now visible beautifully with great snowfields and glaciers. Turning south-east we had the magnificent Hlunpo-gangri to our right for several days, and for six days we followed the big river Buptsang-tsangpo up to Samje-la, situated in the watershed, and now it struck me that only Trans-Himalaya was the right name. So I had controlled the existence of the system some 110 miles further west from Angden-la. It was an agreeable feeling to go down along rivers reaching the Indian ocean, the Samje river, the Rukyok-tsangpo and Chaktak- (not Charta, which is wrong) tsangpo. We met and passed several salt caravans to and from Tabie-tsaka; one of them told the authorities of Saka-dsong that they had seen Ladaki merchants on a very unusual route.

It was my wish to see as much as possible of Chaktak-tsangpo and the gangris from which it gets its great volume of water, and so I went like a thief behind the mountains which are seen from the "tasam," following Chaktak-tsangpo, leaving it to the left where it comes from a valley in Kanchung-gangri, followed its left tributary Gäbuk-chu to the east, and reached an enormous tent belonging to two brothers, Kamba Tsenam and Panchor. They were kind, sold us provisions, sheep, and a pony, and would show us the road over the two passes, Gebuk-la and Kinchen-la, as they said it was impossible to find the road in that labyrinth of mountains without a guide, especially as it snowed heavily now again. They found it very strange that Ladaki merchants took this road, and said it would be a wonder if we could keep clear of robbers; therefore, of course, the Mohammedans began to sing their hymns to Allah again.

We had passed Kinchen-la and camped in a valley going down to Raga-tasam on April 24, when we saw eight men leading their ponies

and coming down from the pass. One could see by their dresses and arms that they were not ordinary nomads. Some of them went straight into Abdul Kerim's tent; their servants camped just outside the entrance of my tent where I kept hidden. They had a very lively palaver with Abdul Kerim; and when they had gone to their camp, from which they kept their eyes upon my tent, I went the back way into my men's tent; and now Abdul Kerim told me they were sent from Saka-dsong, as the authorities there suspected amongst us was hidden Hedin Sahib from the last year. If they were mistaken they had orders anyhow to look through all our luggage; and then Abdul Kerim had only to write a statement that no European was hidden amongst us, and we could continue our journey.

At once I saw clearly the whole situation and the course to take. To *write* such a statement was a little too strong even for my elastic geographical morals, so I told my Ladakis I should tell the Tibetans the truth, happen what would afterwards. The honest men began to weep as children, believing that I should be killed on the spot at least. But I rose and went down to the Tibetans and sat down between them at their fire. I put my hand on the shoulder of my old friend, Pemba Tsering, from last year, and asked him if he did not recognize me at all. He only opened his eyes as wide as he could and looked round at his comrades without saying a word, but his looks meant as much as—it *is* him. After a few minutes we were all friends, chattering and joking as if our meeting had been the most natural thing in the world. I had a delicious feeling of freedom now since I was caught again by the Tibetans; I was no longer a prisoner in my own tent. I did not need any more to paint myself black as a Morian. I could wash—well, I won't tell what the water looked like after the first bath.

If I had not been discovered here I should have continued eastwards, and I had the little *arrière pensée* to come one day as a Ladaki beggar to Major O'Connor, and after some extraordinary conversation I should ask him for some more champagne and tell him who I was. But now we were caught, and now the principal thing for me was to play my cards well. I had crossed the province of Bongba only once, and now I wondered if I should be able to cross it on one or two other lines. Panchor was in our camp, and he told me such a lot of interesting things of Bongba, that if I had been perfectly free to go wherever I liked in Tibet, I should have gone to Bongba, and my dream was now to finish up definitely with the problem of Trans-Himalaya.

I cannot tell now all my extraordinary experiences during the following days, our meeting in Semoku with the authorities of Saka-dsong, the distinguished Pun Dortche Tsuen, with attendants and escort, all in pomp and show, my real friendship with him, our picturesque journey back to Kamba Tsenam's tent, the kindness with which he let me take the very road I proposed—certainly not without

risk for himself—no, I say, the eight days we were together would give material to a nice little book about the ways and views of the Tibetans. Well, I love them, I feel the deepest sympathy with them; they were always kind and polite and hospitable to me, and went as far as they possibly could without being disloyal to their own country, and after half a day's acquaintance we were as if we had known each other from childhood. The Lopliks used to call me Padishahim, or Your Majesty, and of course that title was more than enough for my ambition, but the Tibetans of Bongba called me always Rinpoche, or Your Holiness, the same title as is given to the Dalai Lama and Tashi Lama, and that I thought was a little too much for me. But it was well meant, and I accepted the attention as a quite natural thing. In their company we went round the "High Nun," and at Kamba Tsenam's tent everything was arranged. I should have only five of my men with me, the rest under Abdul Kerim would go over Samje-la to Buptsang-tsangpo, where we had to meet. This was an excellent arrangement; it caused no end of confusion. The people of Bongba certainly believed Abdul Kerim's party was the head caravan, because Karma Puntso himself and six Govas caused them a lot of difficulties, and when I passed with only five men, and now in Tibetan dress, as all my European things were burnt long ago, and my Ladaki things worn out, nobody paid any attention to us. It even happened that nomads asked *me* when the "peling" should come, and I used to say he was behind, and if they kept their eyes opened they should see a most extraordinary fellow. So far as to Buptsang-tsangpo I should have an escort of ten soldiers, and they proved to be awfully fond of rupees.

The last evening we were together with the Saka authorities I invited them to a feast in my tent, in front of which a big fire burnt, and round it the Ladakis danced the dances of their country. I believe the Tibetans had never been so amused in their lives; they laughed, cheered, clapped their hands, and began to take part in the songs, and the whole time the snow came down as never before. It was late when the fire died away and my guests went to their own tents.

On May 6 we said good-bye to our new friends, and went straight north to the most important and interesting of all my Trans-Himalayan crossings. In the evening, in Gyegong-lungpa, a fellow came to my tent, telling me he had seen me seven years ago in Nakchu, and when I asked what his profession was, he answered—robber; but that is another story, as Kipling says. By the way, Kamba Tsenam told us that he was "the father of all Tibetan robbers," and a great friend with them. The next day we crossed by Gyegong-la the Kanchung-gangri range, which is not the head range, but broken through by the Chaktak-tsangpo. In Lapchung-tso, situated to the north of this range, all the rivulets meet, which, coming from the head range, form the upper Chaktak-tsangpo. Here we passed a great trade road, being also a pilgrim's road,

to Kang Rinpoche (Kailas). The country of Lapchung is very high and cold, and the winter remains here much longer than elsewhere in the Trans-Himalayan Alps. Several important rivers begin from this upheaval: the Keddo-tsangpo, Raga-tsangpo, and Chaktak-tsangpo to the south, Buptsang-tsangpo and Soma-tsangpo to the north.

On May 12 we went over Sangmo-bertik-la, surrounded by glaciers —the rock, as in all Trans-Himalayan passes I know, consisting of different varieties of granite. Wild yaks are numerous. Almost every day we had storm and snow. So we crossed the Soma-tsangpo, which is, I should say, the biggest of all rivers in the interior of Tibet. It comes from the western side of the Shuru-tso range and empties into Teri-nam-tso. May 19 we crossed Teta-la, from where one has the most brilliant view over the whole Teri-nam-tso, Trans-Himalaya, Targo-gangri, and Shakangsham. In this clear atmosphere one sees some 100 miles distant; everything is light blue, rose and white, and often the boundary between a high mountain range and heaven is only marked by the white dotted line of the eternal snows. Shakangsham is a kingly mountain, raising its shining white head like a lighthouse over the gigantic mountain waves of lonely and desolate Tibet. It dominates a wider area than any other gangri on the plateau-land, it tells you the road as the stars in the night, and at last it disappears under the horizon as a dream of snow and roses. And the lake is marvellous; one is charmed and fascinated by the intensity of its colour, at the side of which the heaven becomes pale and the torquoise loses its attraction. The lake has been almost correctly placed by Nain Singh, although he has never seen it, only heard of it. He writes the name Tede-nam-tso; it ought to be Teri-nam-tso, or the "Throne mountains heaven lake." In its eastern part there is a picturesque rocky island. The water is salt. Nain Singh's Ngangon-tso, nobody had ever heard of here. Two days we followed the southern shore to the west end, and then went up to Mendong-gunpa on the Soma-tsangpo. The monastery has two Kanpo-lamas, one of whom is a rinpoche, sixty monks, and seventy nuns, all dwelling in very comfortable black tents. I suppose they have great fun together in the long winter evenings.

So we went up the Soma-tsangpo, crossed Goa-la, left the little Karong-tso to our left in Bongba-kemar, and followed one of the great "tsalams," or salt-roads, from Raga-tasam to Tabie-tsaka, left to our right Chunit-tso, which we knew before, and reached the Buptsang-tsangpo in Bongba-kebyang, our meeting-point with the caravan which had disappeared altogether. On June 5 we said good-bye to the soldiers, and for three days we followed the Buptsang-tsangpo down to its mouth in Tarok-tso. Only two very poor peasants followed us, and I could have gone wherever I liked.

Tarok-tso has fresh water, but no visible outlet, showing that its water goes underground to Tabie-tsaka. It was my wish to visit this

THE SOURCE OF THE BRAHMAPUTRA.

important salt depression, where so many roads meet from all sides of southern Tibet, but the Gova of the place refused it, telling me to take the mountain road, which of course proved to be much more interesting, as I got the remaining unknown part of Trans-Himalaya very clear, and this would have been absolutely impossible if I had taken the Tabie road. And I could see Tabie-tsaka from a high mountain. The salt is said to be upon clay, and there is very little water. Natives of Bongba may break as much salt as they like; other caravans have to pay some tengas to Devashung for every hundred sheep-loads.

So we passed Lunkar-gunpa, which has twenty lamas, four nuns, and two rinpoches, being a daughter temple of Sera. Some days north, not far from Lakor-tso, there is Marmik-gunpa, with twenty-five monks and six nuns, and also affiliated to Sera. Lunkar-la is situated in the same range, which is called Hlunpo-gangri, north of Saka-dsong, but it is not a first-class watershed, as it divides the water only between Tarok-tso and Poru-tso; to this lake Goang-tsangpo goes down. Poru-tso is salt, and its old beachlines, which I measured, are 108 metres (354 feet) above the present surface of the lake, showing an enormous desiccation. At Lakor-tso I had measured old shorelines 133 metres (436 feet) high. Then we crossed Nyapchu-tsangpo coming from Men-la in Trans-Himalaya and going to Poru-tso; west of this lake we went over the beautiful ice- and snow-covered Surla range—I call it so from Sur-la, a rather high and difficult pass. On the western side is Rigi-changma, or Rundor; and here we followed north the big river of Pedang-tsangpo down to Shovo-tso, which also is salt. Our guides were two boys, one of them ten years old. I really do not know what the Tibetans were thinking of, leaving us quite alone.

From Tajep-parva-la one sees almost the whole Nganglaring-tso—called Ghalaring-tso on our maps. I suppose some pundit has discovered the lake, although I am not sure if he has ever been there, because the map is very wrong. He says, "Monastery on island," and has one little island in the lake; there are five islands, but not a single monastery; and he makes the lake extend from north to south instead of east to west. We followed this big salt lake for two days west; from the south Sumdang-tsangpo comes out. From south-west comes Lavar-tsangpo, which joins with the Aong-tsangpo from west-south-west, a river which begins from the eastern side of the mountains which to the west give rise to the Indus.

On June 26 I camped at Selipuk, and was received with the greatest hospitality by the lamas of this temple. One of them I had met in Raga-tasam, another in Lelung-gunpa last year, and the Pun, Sonam Ngurbu, of Chokchu, was just here on his prilgrimage to Kang Rinpoche. Him I knew at Shigatse, and he was very polite, as he had seen how well the Tashi Lama had received me. It was interesting to see the Pun's caravan; he had a real village of tents, travelled with all

his household, a hundred persons, had four hundred yaks and four hundred sheep, and a great and picturesque escort of armed men. He has two younger brothers, and all three have two wives together, that means two-thirds of a wife each, which I think is a rather funny invention. I was very short of money, so his presents of tsamba and rice and sugar were very welcome; all our silver was with the head caravan, and when those fellows found us two days later I had exactly one tenga (= six annas) left, and was about to sell ponies, revolvers and watches as a wandering Jew.

From Selipuk we went south-west to Tokchen. As this line is parallel with my journey to Yumba-matsen the previous year, it is of great interest. Here we cross the Trans-Himalaya by the two passes Ding-la and Surnge-la, Ding-la being very high, Surnge-la easy, although it is the head pass, the watershed between Lavar-tsangpo going to Nganglaring-tso and the Sutlej. North of Surnge-la is Argok-tso, from which a tributary goes to Aong tsangpo. Everywhere it would have been very easy to slip away to the north or east or anywhere, as nobody looked after us, but by that time I had got about enough of Tibet after those two long years.

Now only a few words as a *résumé* or conclusion about Trans-Himalaya. The map shows that those two years of wanderings circulate around and across Trans-Himalaya, and that this mountain system has been the chief object of my attention, and I believe I will call my next book, the dedication of which H.E. the Viceroy has kindly accepted, 'Trans-Himalaya.' Because, even if certain parts of it were known before, Trans-Himalaya as a whole geographical unit is a new conquest on our Earth, a new geographical region and signification, that has been more neglected than even the moon, and now it will be introduced for evermore into geographical literature, and the poor schoolboys of future generations will get a new name to remember.

Himalaya has always been regarded as the strongest possible fortress for India against eventual dangers from the north; let us not forget that this fortress-wall, this natural defence of solid granite, is *double*, and it would be rather amusing to see a northern enemy try and jump over those two walls with the Indus-Brahmaputra grave between them. The Capuchin Father Georgi tells us in his admirable book, 'Alphabetum Tibetanum,' how the great Dsungar Khan Tsagan Araptan in 1717 sent an army under Seren Donduk from Khotan through the whole of Tibet to Lhasa, and how this army, although frightfully diminished and several times beaten by the Tibetans, could conquer Lhasa in the time of Ngavang Yishe Jamtso Dalai Lama. And we know from Turner, and lately from Sir Thomas Holdich's fascinating description, how Emperor Kiang Lung in 1792 sent an army of 70,000 men from Mongolia, Sechuan, and Yunnan, to Tibet, and how this

KAILAS FROM THE SOUTH-WEST.

army beat the Gurkhas from Nepal both at Tingri and Kuti since the Gurkhas had plundered Tashi-lunpo twice. But those performances of very irregular troops can hardly be compared with modern warfare. Even light field artillery could only with the greatest difficulty be transported over Tibet, and a strategical railway would be an absurdity. In the great latitudinal valleys there is no hindrance to a railway, but I cannot see how the material could be brought there, and then—those valleys do not lead to India. I have tried with camels, highland ponies, Tibetan mules, yaks and sheep, but as a rule one crossing takes ninety or ninety-three per cent. of the caravan. Often one camps at a spring where the grass is just sufficient for one's animals, but how should it be sufficient for an army. As a rule even a little but strong caravan is spoilt and ruined before it reaches those parts of Central Tibet where grass is abundant, and then it is of no use to try with ponies and mules from the lowlands. My experience has always been that ponies from Eastern Turkestan are the first to die, whereas the Sanskar ponies are the best. I think it is difficult to find another country that has got—from a strategical and defensive point of view—such a favourable geographical situation as India, and all those fears expressed by Vambery or General McGregor are, to use rather a polite word, much exaggerated.

As to the name Trans-Himalaya, I should not have introduced it into geographical literature unless it had had tradition for itself, and the Viceroy of India had given his approval to it, and I am glad to say His Excellency has found it good. As I have said, I was about to call the system, Nien-chen-tang-la, or Hlunpo-gangri, but by that time I had no clear conception of the enormous dimensions of these mountains. Such names are not sufficient. Then I was thinking of "the South Tibetan Mountain system," but that is an ugly and uncomfortable name, whereas *Transhimalaya* tells us at once that this mountain system is situated on the other side of the Himalayas, and is thus a real scientific and characteristic name that cannot possibly give rise to any kind of confusion or misunderstanding. And we have not to go far into Asia to find cases of precedence. Sakaspijskij Oblast, or Transcapsia, is the great province on the other side of the Caspian Sea. Transcaucasia, Transoxiana, and Transbaikalia are all names that do not need any further explanation. The Transilenian Ala-tau is the range situated on the other side of Ili. But the most beautiful case of precedence is found in Fergana, south of which province is the Alai Range. South of Alai is the great broad valley of Kisil-su, being a right tributary to Panj or Amu-darya, and south of this valley is a range called Transalai, because it is situated on the other side of the Alai range. South of Transalai is the plateauland of the Pamirs. Now everybody will see how very like this orographical arrangement is to our present case, the plains of Fergana corresponding to the plains of Northern India, Alai to

Himalaya, Kisil-su to the Indus-Brahmaputra valley, Transalai to Trans-Himalaya, and the plateauland of the Pamirs, the Roof of the World, to the plateauland of Tibet.

Trans-Himalaya is one of the greatest mountain systems on the earth regarding its length, breadth and height, and it can only be compared with the Himalayas, Kwen-lun, Arka-tagh, Karakorum, Tien-Shan, the Cordilleras de los Andes, the Rocky Mountains. From Nub-kong-la to Ladak it is 1100 miles long, but east of Nub-kong-la it continues no doubt some hundred miles south-east and west of Ladak; if it can be proved that it is in connection with the Hindu-kush, its length should be some 2000 miles.

Nowhere is it a single range, it is at least two, but as a rule three or four. In the south its frontier is clearly given by the Indus-Brahmaputra valley; in the north I should say the belt of central lakes, the eastern discovered by Nain Singh, the western by me, is a quite natural and practical boundary, as the ranges situated to the north of those lakes, although some of them may be interwoven with the northern ramifications of the Trans-Himalayan ranges, ought to be called, "The Central Tibetan Alps." They are much lower than the Trans-Himalaya. On both sides of them there is comparatively low land, two latitudinal depressions corresponding to the great latitudinal valleys of Chang-tang. In the northern depression we have the Sachu-tsangpo, Selling-tso, Chargu-tso, Addan-tso, Bogtang-tsangpo, Tong-tso, Lakor-tso, Luma-ring-tso, etc.; in the southern: Kyaring-tso, Tsiku-tso, Ngangtse-tso; Dangra-yum-tso, Teri-nam-tso, Tabie-tsaka and Nganglaring-tso, whereas Nam-tso, Shuru-tso, Karong-tso, Chunit-tso, Tarok-tso, Poru-tso, Shovo-tso, Argok-tso, and Panggong-tso more intimately belong to the Trans-Himalayas. Amchok-tso, Lapchung-tso, and Senit-tso are situated south of the head watershed.

The breadth of the Trans-Himalayan system, where it is broadest, is some 120 miles, whereas the broadest part of the Himalayas is about 200 miles. The average breadth of our system may be said to be 80 to 100 miles; it is broadest in the middle, in Bongba, and becomes narrower to the east and west, at Panggong-tso, for instance, its breadth being only some 30 miles.

I have mentioned the principal eastern passes, and will now add some more to the west. Between my two passes, Angden-la and Sangmo-bertik-la, are Tsalam-nakta-la, Dombe-la, and Nakbo-kongdo-la, the first of which is important, as a great salt road crosses it. Between Sangmo-bertik-la and Samje-la are Saggo-la and Dicha-la, both of which I could see from my road. Then comes the great gap between Samje-la and Surnge-la, where I have not made any crossings, and where the following passes are situated: Dsalung-la, Lungmar-la, Pechen-la, Lungnak-la, Jor-la, Ganglung-la, Men-la, Pedang-la, Gebbji-la, and Tarkyang-la. West of Surnge-la is my Lachen-la. There are said to

be some other passes used only by hunters, shepherds, and robbers, but not for trade, travelling, or pilgrimage. West of Yukti-la, which, I believe, has been crossed by Mr. Calvert some four years ago, there are several passes, most of them easy, but some snowed over and closed in winter.

The orographical and hydrographical rank of the Trans-Himalayas is more distinguished and important than that of the Himalayas. The western Himalayas are a watershed between the Indus and its tributaries, the eastern part between the Brahmaputra and the Ganges; but every drop of water that falls in the Himalayas goes to the ocean. On the other hand, almost the whole central part of the Trans-Himalayas is a watershed between the Indian ocean to the south and the self-contained plateau depressions to the north, from where the water never reaches the ocean. In the far west the Trans-Himalaya is also a watershed between the Indus and some of its higher tributaries, and in the far east it is a watershed between the Brahmaputra and the Salwen. Except the Salwen, there is, within Tibet, only one river that, beginning from the northern side of the Trans-Himalaya, reaches the ocean; but this river is a lion, and the Tibetans call it also Singe-tsangpo, the Indus, which breaks through the range in a transverse valley. Other rivers from the northern side of the Trans-Himalaya are doomed to die, or rather, evaporate in salt lakes without outlet. From east to west the principal of them are: Ngang-chu, Ti-chu, and Bo-chu to Nam-tso, Ota-tsangpo, and Bara-tsangpo falling into Kyaring-tso, which is a fresh-water lake; Tagrak-tsangpo to Ngangtse-tso; Targo-tsangpo to Dangra-yum-tso; Soma-tsangpo to Teri-nam-tso; Buptsang-tsangpo to Tarok-tso, which is fresh; Goang-tsangpo and Nyapchu-tsangpo to Poru-tso; Pedang-tsangpo to Shovo-tso; Sumdang-tsangpo, Lavar-tsangpo, and Aong-tsangpo to Nganglaring-tso. The great geographical homology of this arrangement is very curious and interesting.

The principal Trans-Himalayan ranges are, Nien-chen-tang-la, which further west is called Kanchung-gangri, and dies away to the north-west, north of Samje-la, then the Targo-gangri—Shuru-tso—Lapchung range, finishing at Tarok-tso, and north of it is the Teri-nam-tso range. Further west we have the Hlumpo-gangri-Lunkar range, one of the very highest, and then the Surla range between Poru-tso and Shovo-tso. South of Selipuk is the Ding-la range and the Surnge range, which is the same as the one north of Kaïlas, and which further west is broken through by the Indus.

Transhimalaya is situated in or touches the following provinces: Kham, Nakchu, U, Tsang, Naktsang, Saka, Chokchu, Bongba, Rundor-Selipuk, Singtod-singmet, Ngari-khorsum, and Rudok; that is to say, most of inhabited Tibet.

The province of Bongba, and that of Chokchu, were the only ones in Tibet which hitherto have remained absolutely unknown to

Europeans—I believe even their names were unknown. Bongba is divided into twelve districts, with a Gova as chief of every one of them. It is a well-populated country, with a great many tents, sheep, and yaks; thus the district of Bongba-changma was said to have 300 tents. During such a year as this, when the grass is bad, as there was no rain in 1907, a great part of the nomads go north to the central plateauland where the grass is better.

The province is crossed by innumerable roads. I distinguished seven different sorts of roads — gold roads, salt roads, trade roads, administrative roads, pilgrims' roads, nomads' roads, and robbers' roads. The last category are practically no roads, as they go where nobody else is going. The Serpun-lam, or "the gold-inspectors' road," also called Ser-lam, or "the gold road," is one of the most important roads in all Tibet. It begins from Lhasa, crosses Guring-la, passes Shansa-dsong, goes south of Dangra-yum-tso, north of Teri-nam-tso and Tabie-tsaka, crosses the Surla range in Ka-la, and continues to Selipuk, Yumba-matsen, and Tok-jalung. The salt roads, or "Tsalam," converge from all parts of Tibet to Tabie-tsaka, and many of the Trans-Himalayan passes I have mentioned are taken by the salt caravans. By administrative roads I mean simply local tracks used by representatives of certain districts, who, on a certain day every year, come to a certain place where the Government officials meet to collect the contribution they have to pay for the right of using the grazing-grounds to their flocks.

But now I must finish, and I hope you will excuse the length of this paper. I wrote it between Selipuk and Tokchen, and it is forty-three pages long in manuscript. So, as my diary is a little more than 6200 pages long, I should have to deliver one hundred and forty lectures like this if I should be able to give all the information I have brought home. This lecture is thus a very short account of a very long journey, the results of which it will take two or three years to work out. But, once put into order and published, I hope it will prove to be of some use to India, and then my work in the grand loneliness of Tibet will not have been in vain.

The PRESIDENT (before the lecture): We welcome here to-night the man who, without doubt, has done more than any single individual has ever done to add to the knowledge possessed by the civilized world of Central Asia. It is useless to attempt to condense into a few short sentences all that Dr. Sven Hedin has done for geographical science, and I shall limit myself to reminding you very briefly of the occasions of his two last visits to London. The first of these two visits was in 1898, shortly after he had concluded his great four years' journey in Central Asia, a journey in which, in the opinion of your President, Sir Clements Markham, he encountered "desperate dangers and hardships," and did work which in the circumstances was notable for completeness and thoroughness. Not long after Dr. Sven Hedin had described to us his experiences on that journey, he was awarded

our Founder's Medal for having crossed the Takla desert for the first time, and for having solved various important geographical problems.

In 1903, after the lapse of five more years, three of which our guest of to-night passed in the same inhospitable regions, he was with us again describing his adventures, and again, in the words of your President, proving himself to be "a scientific geographer of the highest rank." During that visit we honoured him with the award of the Victoria Medal, the medal given occasionally for scientific geographical work of exceptional merit; in this case, for investigations concerning the great plateau of Central Asia, the Tarim valley, and the Lob regions.

Again six years passes. Again our indefatigable explorer traverses unknown regions for three years. Again he returns with his hands full of carefully gathered scientific facts. Again we accord to him the most hearty welcome and congratulations. With the record I have so briefly touched upon, we know full well what to expect from Dr. Sven Hedin, and in our expectations we shall not be disappointed. I will, therefore, delay you no longer, but will at once ask Dr. Sven Hedin to kindly deliver his lecture.

After the lecture, Lord Morley of Blackburn: I rise to propose a vote of thanks to Dr. Sven Hedin with every assurance that it will be cordially welcomed in every part of this hall. And not only in this hall, but the welcome you have given to-night to the lecturer will, I am confident, be re-echoed all over the country wherever Dr. Sven Hedin may think it worth his while to pay a visit. He has, in the discourse he has favoured us with, not only given us a remarkable account of a remarkable achievement, but he has brought us face to face with the man. He has shown us, as he has shown the world almost ever since he was a schoolboy, not only that he is a born geographer, but that he is a man with a pity in him, with a sense of justice in him, with a good temper in him, qualities which would save all explorers a vast deal of trouble if they would but imitate our lecturer. There has been no bloodshed, so far as I understand, in any of his explorations. He has raised no ill-will anywhere. He has shown us how he is full of pity, and some of us at all events, with ideas of our own, think with him in what he has said about dogs, and were with him when he described the longing, wondering, melancholy eye of the dogs to whom he was bidding farewell. It occurred to me, while I was listening to Dr. Sven Hedin, how different is the career and how different the duties of a great explorer from those of a politician. He told us that he tried to drive a flock of sheep, and that he found he had no gift for driving sheep. If he had been in the profession of politics, he would have found that those gifts were sorely needed. I mention that because it occurs to me that Dr. Sven Hedin may think that the Secretary for India, who, after all, holds the keys of the frontier gates of India, is, unlike himself, a hard-hearted, a cold-blooded, and a timorous man. He will well know the circumstance to which I am now referring, the circumstance, namely, that we thought it inexpedient that he should approach Tibet from the Indian side. I will not be guilty of the intolerable bad taste of attempting for a moment to show that my decision was not over-cautious. I think a good deal of what Dr. Sven Hedin has said to-night rather shows that the decision was a right one as far as it went. But I will not argue it because, after all, be the decision as wrong as you like, Dr. Sven Hedin has to-night had his revenge, for he has drawn me captive—though captive impenitent—at his car, and I am very glad to find myself able to congratulate him on the great exploit he has performed in spite of it. The subject of Tibet not many years ago was a topic of some warm political controversies, not purely party—the controversy was as much within one party as in the other. It may be that the topic may again be revived. It may be that some of the points raised by it may be revived by Dr. Sven Hedin's explorations, and he may have

something to tell us some of these days, not to-night, upon this controversy. And whatever he may tell us, we shall know that we are being told by a man of scrupulous honesty and integrity and of enormous industry in investigating all the phenomena before him, because, so far as I am acquainted with his books, Dr. Sven Hedin is not content with geographical research, but busies himself with historical research as well. But be that as it may, we are every one heartily glad to have heard his lecture to-night. We are also very glad to have seen so brave a man, a man who has performed such a wonderful geographical achievement, face to face. He has got, I think, some two or three years' work still before him in working out all his plans and drawings, and we all hope that he will have the same kind of success in completing this portion of his task as has followed the earlier portion of it. I do not do wrong, I am certain, in expressing on behalf of this very great and rather wonderful gathering, our gratitude to him and our sense of the wonderful qualities which he has shown, and of the great and valuable additions he has made to geographical knowledge. I beg to propose that our thanks be given to Dr. Sven Hedin.

Colonel Sir Henry Trotter: As an old explorer in Central Asia, I have been asked to second the vote of thanks to Dr. Sven Hedin for the admirable lecture he has given us this evening. I am especially pleased to do so as I was intimately associated with the veteran explorer Nain Singh, whose name has so often been mentioned this evening, and described by the lecturer as "the admirable and noble Pundit." On my return from Central Asia in 1874, I started him from Ladakh on the mission to Lhasa which gained him the R.G.S. Gold Medal, and on his return to India I worked up his observations and prepared his map and report, so that I have been deeply interested in noting where his work came in contact with that of our distinguished guest, and was especially struck with the observation that on arrival at the Teri-nam lake, he found that its position had been almost correctly placed by Nain Singh, although he had never seen it—only heard of it. The dotted line which showed its approximate position on our maps for the last thirty years will now be replaced by a correct delineation. Still more important, however, is the confirmation of Nain Singh's observations to peaks of a high snowy range, one of which he estimated to be 25,000 feet high, lying to the south of Dangra Yum lake. I recollect that at the time grave doubts were thrown by unbelievers on the existence of these mountains, but the correctness of his observations has now been verified.

It is difficult perhaps for most of those present this evening to realize fully the hardships and difficulties encountered in such a journey as we have heard described this evening. Dr. Sven Hedin, for instance, says in one short sentence, "On the heights of the Bukamanga range we lost nine mules in one day." I well recollect on the journey of the Forsyth mission to Kashgar in 1873, one mule lost its footing and fell several hundred feet into the torrent below. Its load consisted of twelve months' supply of brandy and whisky for the expedition, and its loss was most serious; what, then, must be the effect of the loss of nine mules in one day? It is difficult to realize. The wonderful energy and perseverance of the lecturer when driven off the ground and compelled to go round to Leh and start a fresh expedition in order to complete the task he had set himself to do—the way in which the almost insuperable difficulties were faced and surmounted is worthy of our highest admiration, and is an example to us all.

Another important factor to be noticed in judging of the difficulties of the work is that the general height above sea-level of the Tibetan plateau from which rise the mountain systems we have heard described to-night varies from 13,000 to 16,000 feet above sea-level.

Dr. Sven Hedin has condensed for our benefit three years' hard work into a single

lecture—a most difficult task, especially as we are informed that he has materials for 140 more, and his "geographical conscience" must revolt at leaving so much good matter undescribed. After the hardships and dangers encountered by Dr. Sven Hedin, not only in this but in former expeditions not less adventurous and noteworthy, it is an extraordinary result, on which we must congratulate ourselves as well as him, that he is left alive and in good health to tell his tale, and I am sure that the audience will join enthusiastically in the vote of thanks which it has been my privilege to second.

The PRESIDENT (after the vote of thanks was proposed and seconded): When travellers return to us after long journeys in distant regions, we have not only to obtain from them all that is new to science in their gleanings, but also to note the difficulties under which they have laboured in making their researches. Dr. Sven Hedin has dealt but lightly with the dangers he has encountered; but, in spite of his reticence, his lucid account of his journeying, and the admirable photographs which have illustrated it, have made it clear how full of difficulties must have been the task of collecting the mass of material he has brought back. To few men, indeed, is granted the physical endurance which he has displayed in his ten and more years' wanderings in the desert. And as to his contributions to geographical science, their extent can only be realized by those who have noted the great white spaces which existed on our maps of Central Asia in 1894, how largely these spaces are now covered with the network of his topography, and how comparatively few great problems now remain to be solved. Speaking in 1898, Dr. Sven Hedin said he was glad to find himself placed by the side of our other Gold Medallists—Carey, Ney, Elias, Holdich, Littledale, Younghusband, and Prjevalsky. Let me assure him that we also rejoice to see his name on our walls in that list of our medallists, since, as I have said before, he has done more than any other one man to open this country to our knowledge. Sweden may well be proud of their great explorer, while we must content ourselves with remembering that he is our twice-honoured Gold Medallist. In conclusion, I know I may declare this motion carried by acclamation, and give to Dr. Sven Hedin your most hearty thanks and congratulations.

Dr. SVEN HEDIN: May I express my very heartiest thanks for the beautiful and sympathetic reception I have had to-night in the R.G.S.? It is twelve years since I first had the honour to address your Society, the richest and most famous in the world, and since then I have been overwhelmed with honours, hospitality, and appreciation by the Presidents, Council, and members of the R.G.S., and when I now am here again, I do not feel any more a guest or a stranger, but a friend amongst friends and as one of your own.

It has been a very great pleasure to me to listen to those very flattering and kind words just addressed to me by the President, and they are the more precious to my heart as I know he has also been talking on behalf of the Council and members of the R.G.S.

And I regard it as a special honour that the Secretary of State for India has been kind enough to propose a vote of thanks, and that he has done it in a way that I appreciate more than I can say and that I never shall forget. Three years ago I did not quite love Lord Morley, although even then I understood very well that whatever he did was done in the interest of that great and powerful empire, in whose service he occupies such a high position, full of responsibilities, and I understood that the personal wishes and ambitions of explorers had to come in the second place. But now, since I have travelled for twenty-five months in the unknown parts of Tibet, I look upon the situation in a quite different light. In connection with this journey, there is no man who has made me a greater service than Lord

Morley. When the noble Viceroy of India so very kindly tried to get a permission for me to enter Tibet on the Simla-Gartok road, the Secretary for India refused it. What would have happened if he had consented? I should have prepared a big and heavy caravan in Simla, crossed the frontier, and—been turned out by the Tibetans already at Shipki! It is easy to understand what a great loss of time and money this would have been, as I could not possibly have brought the same caravan all round with me to the Turkestan side.

But Lord Morley did me a still greater service. During the whole time I was in Tibet he kept the frontier between India and Tibet closed to all travellers, and so I was left quite alone with the great white patch which I had decided to explore as carefully as possible. Everybody will understand what that meant for me—especially in a time when the white patches on the map of the Earth are not very numerous. If the frontier should have been opened by some new agreement, I am afraid the Bongba province would have been overwhelmed by explorers, and I should have been obliged to give up a good deal of the conquest which I desired to save for myself only. And for my life I *would* not capitulate on any single point, as some of the most beautiful and important problems of Asiatic geography were to be solved only on this very white patch. So it is not only a *manière de parler* when I say that nobody has ever done me a greater service than the Secretary of State for India; and if I did not love him three years ago (which was for a very short time only), I hope I may take the liberty now, and for the rest of my life, to reckon Lord Morley amongst my very best friends.

Let me also express my sincere and hearty thanks to Sir Henry Trotter for the excellent and appreciative speech he has been kind enough to address to me, and which is the more valuable for me as it comes from a man who knows so much of Tibetan geography, and who has played such an important part in the history of exploration in that mysterious country. I have always admired the clever and careful way in which Sir Henry worked out the maps, notes, and observations of the great Pundit, Nain Singh, more especially of his journey 1873-74, which is one of the most important that ever have been undertaken in Tibet. I am really proud of the words Sir Henry Trotter has just uttered.

The reception I have had to-night by the President and members of the R.G.S. I regard as a new and very great honour added to those which I have received already years ago. And may I finally express my very hearty thanks to all those distinguished guests present who have spared some hours of their valuable time for coming and listening to the story of my last journey in the fascinating land of the eternal snows, the lamas, and the mysterious formula "On mane padme hum"!

II. DISCOVERIES IN SOUTHERN TIBET.*

By Dr. SVEN HEDIN.

When I left Stockholm on June 24, 1899, for my fourth journey into Central Asia, one of my chief objects was to try and find the source of the Indus, but although I did my best to penetrate to that part of the forbidden country, I had to give it up altogether on account of the opposition of the Tibetans. When I again

* This must be regarded as only a preliminary statement on the points in dispute, necessarily written in some haste.—S.H. Royal Geographical Society, February 23, 1909.

left Stockholm on October 16, 1905, for a new journey in Asia, the source of the Indus still remained one of my greatest ambitions, but the strongest attraction was to fill up the great white patch on our maps of Tibet, situated north of the Tsangpo, between 81° and 89° east of Greenwich. This was a region which had never been crossed by any European explorer, nor by any of the native explorers trained and instructed by Montgomerie, Trotter, and other British officers in India.

Part of this vast area was, to some extent, known to the Chinese; the Shui-tao-ti-kang, or "ground lines of hydrography," contains a description of it, and some other Chinese geographical works deal with it. During my stay in Kyoto, Prof. Ogawa, of the Kyoto University, kindly made translations of those parts in the Chinese books which could be of special interest in connection with my own discoveries in the same country. In 1708 the great Emperor Kang-hi ordered the Jesuit missionaries in Peking to compile a map of the whole empire, which was completed in 1718. In 1717 two Lamas, who had been trained by the Jesuits—in the same way as the Pundits in India later on—were able to deliver to the Fathers a map of Tibet, which contained the only information we possessed of the great white patch—even so late as 1906. From this map D'Anville has entered upon his famous map of 1733 a labyrinth of rivers, lakes, and mountains. On D'Anville's map we find Lanken and Mapama, *i.e.* Langak-tso and Tso-mavang (or Mavam), from which he makes the Ganges take its origin. The rest of D'Anville's hydrographical and orographical confusion, in which it is a hopeless task to try and identify the geographical lines with the reality, I only find two lakes which really exist, namely, "Tarouc-yomdsou" and "Tchapie-dsake-ton-psou," the first being called Tarok-tso, the second Tabie-tsaka. The fact that these two lakes have been comparatively well entered on the map, seems to depend upon their being known all over Tibet, as Tabie-tsaka provides a very great part of the country with its supply of salt, and is visited by innumerable salt caravans, and because several of the most important roads of the interior of Tibet meet at Tabie-tsaka. The rest I cannot recognize, unless Tankin-yamso is meant to be Dangra-yum-tso, although it is connected with Tengri-nor by the river "Tarcou Tsangpou," a connection which does not, of course, exist in reality; but it may be a confusion with Targo-tsangpo, which empties into Dangra-yum-tso, and about which Nain Singh got some information in 1874. Part of the geography of D'Anville's map has been entered by Dutreuil de Rhins upon his map l'Asie Centrale, a map which appeared some years ago in a Chinese edition in Shang-hai.

The material on D'Anville's map for the region north of the Tsangpo seems never to have been accepted by British or German geographers, at least not on the map published by the Royal Geographical Society under the title of "Tibet and the Surrounding Regions," nor on the excellent map of Tibet, which is No. 62 in Stieler's Hand-Atlas—and these two maps are by far the very best general maps of Tibet I have ever seen, and perfectly up to date in all geographical details. On the British map the unknown country has exactly the same aspect on the edition of 1906 that it had at its first publication in the *Geographical Journal*. The single word we find on the edition of 1906 on 'Tibet and the Surrounding Regions,' which is perfectly correct, or which rather *was* so in 1906, is the word *Unexplored*, in big letters, whereas the word Dokthol province has to disappear, as it does not exist in reality; the name proved to be absolutely unknown to the natives wherever I asked for it.

It may be of some interest to point out some of the geographical information of the above-mentioned map. The country between Mount Kailas and Jiachan on the main branch of the Indus is perfectly white on the map, which is correct, as nobody has ever been there, and if anybody ever *had* been there it is difficult to understand why his information should not be used on the map of Tibet issued by the R.G.S.

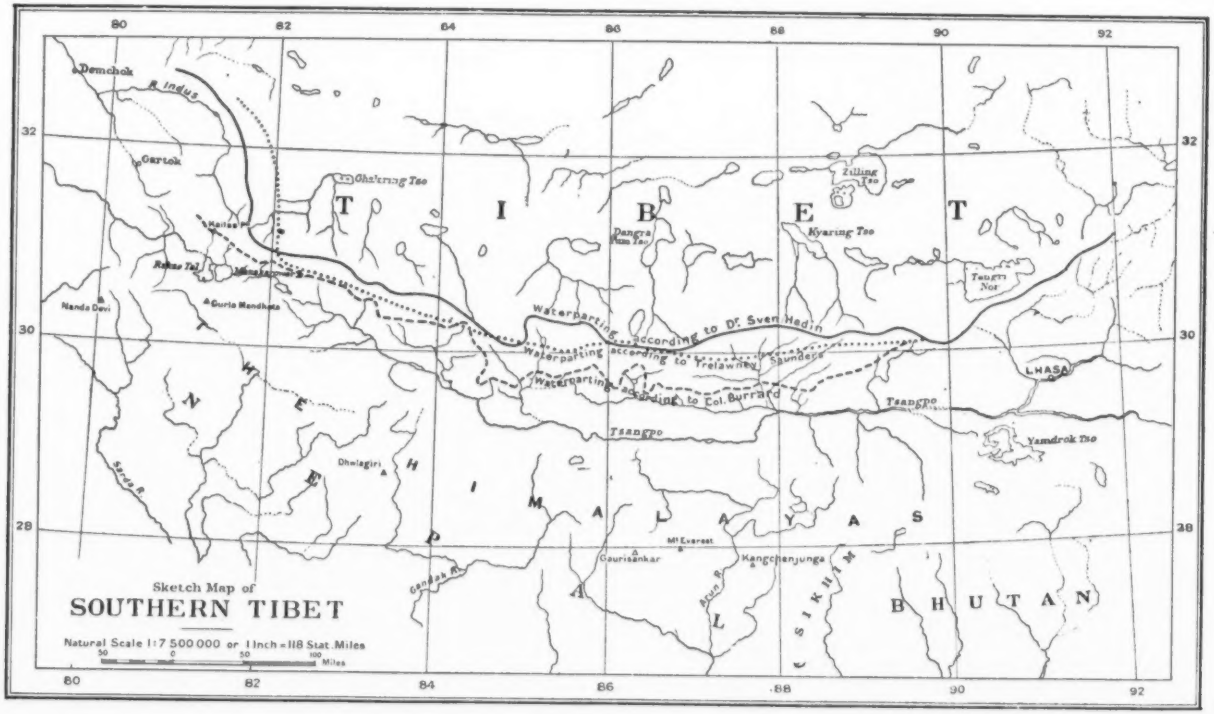
The uppermost part of the Indus, in the province of Singhtod, is a dotted line, the beginning of which is situated about 30 miles from the real source of the Indus. To the east of Singhtod there is some detail on the map. I do not possess the report of the Pundit who has collected this information, but I have the impression that it is partly founded upon verbal communication, because it is so extremely wrong. His river Sumnu-chu is identical with the Lavar-tsangpo and its tributary the Aong-tsangpo, which correctly comes from the south-west. The Sumdan-tsangpo comes from the south, from Trans-Himalaya, and it is on this river, on its left bank, that the great temple of Selipuk is situated. His Ghalaring-tso is identical with Nganglaring-tso, but it is not oblong from north to south, but from east to west; it does not contain one island, but at least five; and there is no monastery on any one of those islands. His peak Khala, south-east of Selipuk, may be a confusion with the very important pass of Kha-la, which is situated in a very high mountain range stretching north-west to south-east, and this pass is situated east-north-east of Nganglaring-tso. Now, of course, one can leave the question open whether it is better to accept such a confusion of geographical information than to leave a perfect blank on the map. Some of the information collected from the natives by the Pundits, and which I have tried to use for geographical conclusions, both in my 'Scientific Results,' vol. iv., and during my last journey, have proved to be so utterly wrong, that I should very much have preferred if the map had been left blank. On the other hand, I am glad to express my greatest admiration for those parts of the map where the Pundits have really been, and for their mapping of parts of Tibet which they have seen with their own eyes, and which are always very correct.

On the north of the white patch we have Nain Singh's, Littledale's, and my own routes, and south of these a perfect *terra incognita*; then to the east we have Nain Singh's dotted lake, Tede-nam-tso, which he did not visit, only heard of. The situation is about correct, the real name is Teri-nam-tso, and the lake is oblong from east to west, not from north to south. Ngangon-tso nobody had ever heard of; Dangra-yum-tso is much too big on Nain Singh's map; it is wandered round in five days by pilgrims on foot. The Mun lakes, which never have been visited by any explorer, seem to be situated west of southern Dangra-yum-tso, not south of the lake, where, instead, the great Shuru-tso is situated.

South of the central lakes, Nain Singh's map is extremely fantastical, which must be excused, as he has never visited that part of Tibet. It would have been far better to leave the map blank here than to enter the "Dumphu or Hota Tsangpo" on it. Even in this region all water runs to the upper Brahmaputra, not to Kyaring-tso. There is an Ota-tsangpo coming from the watershed of Trans-Himalaya straight south of Kyaring-tso, but it is very short, and it runs straighter north. Dobo-doba-tso nobody had ever heard of. Daru-tso I have only been able to see from a pass; both the name and the form are, however, wrong. I do not know why the lake Tsiku-tso is not entered on the map "Tibet and," etc., of 1906, as this lake really does exist.

In the south finally, both Ryder's excellent map, which has never been surpassed by any other traveller in Tibet, the map of 1906, and the map in Rawling's "The Great Plateau," give the watershed of the upper Brahmaputra in a perfectly wrong way. The great peaks which are seen from the north along the river, and which were measured by Ryder and Wood, are by no means situated on the watershed, but south of it. The courses of Chachu-tsangpo and of Charta-tsangpo (Chaktak-tsangpo is the real name) are quite wrong, but they are marked with dotted lines, which was quite right, as nobody had ever been in the interior of the so-called "Dokthol province."

It is a very extraordinary fact that a patch of some 65,000 square miles could remain unexplored anywhere on the Earth's crust—except the poles—so late as in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Demchok
R. Indus
Gartok
Ghatrung Tso
Zilling Tso
Kyaring Tso
Dangra Yum Tso
Tengri Nor
Rakas Tal
Manasarowar L.
Nanda Devi
Gurla Mandhata
Waterparting according to Dr. Sven Hedin
Waterparting according to Trelawney Saunders
Waterparting according to Col. Burrard
LHASA
Tsangpo
Yamdrok Tso
Dhaulagiri
Sarda R.
Mt Everest
Gaurisankar
Kangchenjunga
Arun R.
Gandak R.
T I B E T
W E S T E R N
H I M A L A Y A S
S I K H I M
B H U T A N
Sketch Map of
SOUTHERN TIBET
Natural Scale 1:7 500 000 or 1 Inch = 118 Stat. Miles
50 0 50 100 Miles

1906. The following quotation was written in the summer of 1905, and contains my own views on this great unknown country: "In the south the circumstances are different. The shape of Nain Singh's lakes alone suggests that the mountain ranges are there built up with less regularity. They also lie closer together, are in general smaller, but at the same time much steeper, and abound in hard rock. Of this country we possess but the scantiest information, having no knowledge even of what its broad features are like. Within the very last year or two, the extreme south of Tibet, *i.e.* the valley of the Tsangpo, has been reconnoitred by the members of the English expedition, but the whole of the extensive region between that valley and my route to Ladak is an absolute *terra incognita*, and it is just in this broad gap between the central plateau and the valley of the Tsangpo that the forms intermediate between the two are to be found. The investigator who should, therefore, attempt to set forth the general architectural features of the Tibetan swelling would be certain to lose himself in this very gap in guesses and theories devoid of all foundation. Rather than expose myself to such a risk, I have resolved to study that unknown region with my own eyes on the spot. It is only when this gap has been filled up, and the white patches on our maps have given place to new groups of lakes and new mountain ranges—which, in consequence of their altitude, exercise such a profound influence upon the distribution of the rainfall in Central Tibet—and to new rivers, it is only then that the attempt to convey a faithful picture of the morphology of the Tibetan highlands, and to get to the bottom of the genetic causes of the existing surface forms, can be successfully carried out; for it is only then that the necessary material will be available, and the necessary general view of the whole, without which it is impossible to write a physico-geographical monograph of any value. In these circumstances, therefore, I prefer to postpone giving a general account of the country until after my return from the journey upon which I am now about to start." *

The wish to continue my explorations of unknown Tibet, which I have expressed in these words, has now been realized to a much greater extent, and with richer results, than I had ever dared to hope when I left home. It may be a great temptation to sit down comfortably in one's study and build up theories and hypothoses about the most plausible geographical lines of an unknown country, but it is very dangerous to do it, and all those who have tried to arrange the mountain ranges of the "Dokthol Province" have proved to be utterly wrong. It does not need very much intelligence to presume the existence of mountains within the white patch north of the Tsangpo; it is more difficult really to go there and make a map of the country, and only the explorer who does it and brings back a map of the country with him, only he has discovered the mountains, lakes, rivers, and other geographical characteristics of the same country.

In the following pages I have collected some of the information we possessed of the parts of Tibet I have this time visited. The quotations are by no means to be regarded as complete, as I have not had very much time since I returned on January 17, and this paper is only a preliminary one; the complete scientific discussion must be left to my next scientific work. The greatest difficulty for me is now that I cannot possibly enter upon any detail of my own work, which consists of 6200 pages and more than 900 sheets of map, but everybody will easily understand that it must take years to digest the new material.

H. Strachey says,† "The river which drains the greater part of West Nari to

* The author's 'Scientific Results of a Journey in Central Asia, 1899–1902,' vol. iv. pp. 607, 608.

† *Journal*, vol. **23**, 1853, "Physical Geography of Western Tibet," p. 7.

the north-west, called by the Tibetans Senge-tsangspo, *i.e.* Lion river, is now well established (Vigne, Young) as the chief source of the Indus, a fact which English geographers have had to rediscover for themselves within the last half-century, though I find it distinctly stated in a book written by a Tibetan monk 250 years ago. . . . (p. 9) A few (of the many tributaries) are so great as to form an absolute break through the outermost ranges of the snowy mountains and make the sources of some of the Indian rivers absolutely Tibetan or trans-Himalayan. . . . As none of our modern travellers have visited any part of the great transverse watershed that divides the heads of the river Tachok from those of the Langchen and Senge rivers, or Nari-Mangyul from Nari-Khorsum, for any vague idea of its character, we are left to our own conjectures and native report. . . . (p. 36) The basin of the Langchen is lacustrine in its upper part, containing the Konkya lake in Horba without active effluence, and Tso Mapham and Langnak in Kangri with a partial or intermittent one. . . . (p. 37) The watershed between the Indus and Sutlej has a running length of nearly 500 miles, measured from the supposed position of Maryum La to the north-west extremity of sPiti. . . . (p. 38) Little or nothing is known of the furthest sources in Seng-Tot or elsewhere, and the estimate of 50 miles for the remaining course depends upon native reports and conjecture. . . . (p. 39) Its (Sutlej) sources are somewhat complicated (as imperfectly known to us), lying between the Chukar from the Indian Himalaya on the south, the Ser Chu or other streams from the mountains of Kangri on the north, and the effluence from the lakes Mapham and Langak on the east, the two first being permanent, and the last partial or intermittent. The Chukar is said to be as large as the united rivers of Mensar and Tirthapuri, when swelled by the melting of the Himalayan snow in summer; but we do not know whether it maintains this superiority on the average of the year, nor whether the intermittent contribution of the lakes be equal to the permanent effluence of the Ser Chu or other rivulets direct from the Kangri mountains. . . . (p. 49) Its (Mansarowar) effluent runs through an opening in the hilly isthmus into the western lake; I found it a swift stream 100 feet broad and 3 feet deep in October, and its exit from the lake was seen by Mr. Winterbottom and my brother, Richard Strachey, from a height a few furlongs off; though Moorcroft crossed this very place without finding the stream, even in August, the time of highest flood, whether from its being then dry or from its percolating through a bar of shingle close to the lake, as asserted by some of my native informants, is not apparent. The effluence (from Langak to the Langchen river) is from the north point, which I crossed, however, in October without finding any running stream, or any marked channel for one, though the flatness of the ground, its partial inundation in shallow pools, and obvious descent of the level towards the river, entirely corroborated the native accounts of an intermittent effluence in seasons of flood."

These are the chief characteristics of the geography of this interesting country round the Holy lake, which were known in H. and R. Strachey's time. I will specially point out the following: Strachey knew that the eastern branch was the head branch of the Indus, and his estimate of 50 miles to the source depends upon native reports and conjecture. And so it has remained until I discovered the source in September, 1907. Strachey uses the orographical signification of Trans-Himalaya, which has afterwards been adopted by several other geographers, Cunningham, Godwin Austen, Montgomerie, Richthofen, and others. Strachey is quite right in allotting the lacustrine region to the region of the Sutlej river, and he quite rightly regards the question of the sources of the Sutlej as a complicated one. I cannot now enter upon this problem, as it would carry me too far, and I have no time now to consult my maps and my detailed measurements of the volume of water in every single tributary, both to the lakes and from the southern slopes of the western parts

of the Trans-Himalaya. It is of great interest to note that Moorcroft in 1812 did not find any channel between the two lakes, but Strachey found a rather considerable stream, and then Strachey touches upon the interesting question of a possible subterranean connection between the lakes. My own conviction is that there still remains a subterranean effluence from Tso Mavang to Langak-tso, and that the water then continues underground from the last-mentioned lake to Dölchu-gunpa and reappears in the old bed of the upper Sutlej. It is a physical necessity that such an effluence must exist from both lakes, because if there were none the water of the lakes would be salt, or at least somewhat brackish, and in reality it is as fresh as any river- or spring-water. So I regard the source of the Tagi-tsangpo, situated two days' march east-south-east of Tso-Mavang, as the real source of the Sutlej, or, as I have called it, its genetic source. On Strachey's map this river is fairly correctly entered, although its upper part is marked by a dotted line on Ryder's map, and on "Tibet and the Surrounding Regions." On Strachey's map there is a considerable mountain range entered north-east of Kailas, and the sources of the Indus are marked by dotted lines.

I now come to Nain Singh's remarkable journey of 1865,* described by Montgomerie. Amongst the results he mentions is the "fixing generally the whole course of the great Brahmaputra river from its source near Mansarowar to the point where it is joined by the stream on which Lhasa stands."

He is wrong in regarding (p. 146) the "Mariham-la" (= Maryum-la) as the watershed between the Sutlej and the Brahmaputra. "From the Mariham-la the road descends gradually, following close to the north of the main source of the Brahmaputra, and within sight of the gigantic glaciers which give rise to that great river. At about 50 miles from its source the road is for the first time actually on the river. . . . (p. 211) The river Brahmaputra was ascertained to rise in about north latitude 30½° and east longitude 82°. . . . The general direction of the river's course during the first 50 miles was, however, quite unmistakable, owing to the gigantic range visible to the south of it, the large glaciers which filled every ravine of that range evidently forming the sources of the river. . . . From Tamjan there was a good view up the river for a considerable distance. The Tibetans all agreed in saying that it was the main branch of the river."

Neither Nain Singh nor Montgomerie gives a quite clear and unmistakable view of the situation of the real source of the Brahmaputra. Even in the title of the paper the source is placed at Maryum-la, which was crossed by Nain Singh, whereas he did not investigate the real head branch, Kubi-tsangpo, at all. But he says that evidently the sources of the river were situated in the gigantic range visible to the south, and fed by its glaciers, which, in reality, is the case. On his map the Kubi-tsangpo is very incorrect. The map of Ryder is here a very great improvement, but not quite correct, as Rawling and Ryder and their party had no opportunity to follow the head river up to its source. So when I came to this neighbourhood I could not possibly regard the problem of the situation of the source of the Brahmaputra as finally solved, as nobody, except the Tibetans themselves, had ever been to the source and fixed its position astronomically, and measured all the branches and mapped the country round. I must point out, in this connection, that modern scientific geography demands more of an explorer than that he simply says that the source of a river is evidently situated here or there, without going and checking the opinion, which, of course, may be a mistake. Before the map and the measurements are brought home, the personal opinion of the explorer is only of

* 'Nepal to Lhasa, and thence through the Upper Valley of the Brahmaputra to its Source,' vol. 38, 1868, pp. 129 *et seq.*

a relative value. And if the question of the situation of the Brahmaputra's source should have been solved by somebody before, in a critical and scientific way, I should, of course, never have cared to try and penetrate to it. So no European, and no native explorer, has ever been to the source of the Brahmaputra, nor mapped the country round it, until I fixed the place in July, 1907.

On Nain Singh's map there is no connection between the two lakes, but a dotted line from Langak-tso marks the bed of the Sutlej. He makes the Tokchen river greater than the river from south-east (= Tagi-tsangpo), which is wrong. South-east of Mansarowar he has a range running south-west to north-east, which does not exist in reality. He has Mount Kailas on the range of Trans-Himalaya, instead of south of it. East of Charta-tsangpo he has a "high snowy range," and north of Raga-tsangpo another range. Those belong to the Trans-Himalayan system, but are not the head range.

Then follows Montgomerie's "Report of the Trans-Himalayan Explorations in 1867."* "The routes have also defined the courses of both the upper branches of the river Indus from near their sources to their junction, and the conjoint stream from that point into Ladak. Neither of these branches had been previously surveyed in any way, except a small portion of the Gartok branch above Gartok, which had been roughly laid down by Moorcroft. The existence of the eastern branch was doubted by many geographers (it was indicated from native information by H. Strachey on his map), as no Europeans had ever seen it. The Pundit's route has now proved that this eastern branch is the main stream known to the natives as Singhi-chu or Singi Khamba (Lion's mouth), the river Indus itself, whilst the other branch, hitherto generally supposed to have been the main stream, is much smaller than the eastern one, and invariably called the Garjung-Chu. (p. 160) The actual source of the eastern branch or main stream of the Indus was not reached, but the people between Giachuruff and Yiachan said it rose at a place called Gangri-Goorgiap, which may perhaps refer to the Gangri or Kailas peak, but the direction of the course of the Indus, as seen from near Yiachan, pointed rather to the east of that mountain. . . . At the highest point visited the Indus was still a considerable stream. At Giachuruff the ford was always a difficult one, and for eight days after the fall of snow the Pundit experienced, the river was not fordable in any way."

From the map it is easy to see that the Pundit of 1867, on his way to Tok-jalung, crossed the Indus some five days' march from the source. Singi-chu and Singi-kamba mean the river Indus. Singi-kabap, or "the mouth (from which) the Lion (river) issues," is the name of the very source of the Singi-chu, or Indus. Since the Pundit, no explorer has ever been in the country of the uppermost part of the Indus; and as Mr. Calvert, on his very interesting journey, never went to the uppermost part of the Singi-chu, the discovery of the source of the Indus was left to be made by me. Just below the source the Pundit would not have found the same difficulties in crossing as he found at Giachuruff—he would almost have been able to jump over the source-branch. There are several small brooks joining the source-branch, just a little below the source, and their sources, being situated on the northern slopes of the Trans-Himalayas, are longer than the source-branch itself. But as they are frozen and dead in winter, whereas the source-branch always carries water the whole year round, the Tibetans are quite right in calling the Singi-kabab the real source of the Indus. Thus, of course, it was a great mistake to presume that the Indus came from the Kailas peak, the neighbourhood of which drains exclusively to the Sutlej. (p. 161) The Pundit heard of the Shellifuk (= Selipuk) district, which "boasted of some streams, but they all run into a large inland

* *Journal* of the R.G.S., vol. **39**, 1869, p. 158.

lake." The streams are, of course, Lavar-tsangpo and Aong-tsangpo, and the lake Nganglaring-tso.

In the *Journal* of the R.G.S., vol. **45**, 1875, it is stated that the "map of southern Tibet has in our region of Ngari Khorsum not undergone any changes at all from the former;" and on p. 301 we get some information about the "range called by Hodgson the Nyenchhen-thangla chain. . . . The Tsangpu or Brahmaputra traverses the whole region from west to east, and receives tributaries from the Nyenchhen-thangla range on the north, and the northern slopes of the Himalayan outer and inner chains on the south." Hodgson had no personal experience of the country, and it may be regarded as a matter of taste whether Nien-chen-tang-la separates southern from northern Tibet or not. At any rate, it is more correct to say that it is a watershed between Tengri-nor and the Brahmaputra, and, further east, a watershed between the Salwen and the Brahmaputra; and one has always to remember central Tibet as situated between the northern and southern parts of the country.

In his "Narrative," etc., in the same volume * Mongomerie says, "During 1871 a party was organized with a view to exploring some portion of the unknown regions north of the Tibetan watershed of the upper Brahmaputra," and in his memorandum, etc., he says,† "Amongst other attempts to explore the various countries beyond the borders of British India, I have always borne in mind the necessity to explore the vast regions which lie to the north of the Himalayan range, from E. long. 83° to E. long. 93°, and I have consequently, from time to time, tried to get more information as to this *terra incognita*; but since the Pundit made his way from Kumaon to Lhásá, I had not till lately succeeded in getting much advance made to the north of his line of explorations, though a good deal was done to the north of the Mansarowar lake. One explorer made his way from Rudok, on the Pangkong lake, to Thok-Jalung, and thence back to the Mansarowar, passing quite to the east of the great Kailas peak. The same explorer subsequently made his way to Shigatse, but he was unable to penetrate to the north of the main course of the upper Brahmaputra. Though disappointed with this, I continued to try and get an explorer to penetrate into those regions, and after many failures I have at last the satisfaction to be able to report that some progress has been made in exploring to the north of Shigatse and Lhásá. (p. 326) To the south the lake (Tengri-nor) is bounded by a splendid range of snowy peaks, flanked with large glaciers, culminating in the magnificent peak, Yang Ninjinthanglá, which is probably more than 25,000 feet above the sea. The range was traced for nearly 150 miles, running in a north-easterly direction. (p. 328) The proof of the existence of a great snowy range to the north of the Brahmaputra is interesting, the Himalayan system, even at that distance, say 160 miles from its base in the plains of India, showing no signs of getting lower . . . . The route followed by the explorer from Dam-Niargan to Lhásá is the route by which Messrs. Huc and Gabet must have approached that city . . .; one northern tributary of the upper Brahmaputra has been thoroughly explored, thus giving us some idea as to how far back the northern watershed of this great river lies."

It is interesting to find that Montgomerie regards it as a "necessity to explore the vast regions" north of the Tsangpo, and he is right in calling it a *terra incognita*; and so it has remained, except the part between Tengri-nor and Brahmaputra, to which he was able to send out some of his "Trans-Himalayan explorers." Already then, and later on through Krishna, Littledale, Ryder, and de Lesdain, the existence of a magnificent range on the southern shore of Tengri-nor was proved. And thus Montgomerie was able to fix the situation of the great watershed. But he

* *Journal* of the R.G.S., vol. **39**, 1869, p. 35. † *Ibid.*, p. 325.

had never the satisfaction to see the vast country between 83° and 89° E. long. penetrated by any one of the Pundits, and so it has remained until I was able to cross the country and the great watershed on several different lines in 1907 and 1908.

Now I come to Trotter's report on Nain Singh's journey from Leh to Lhasa.* On p. 105 he speaks of Targot Lha, from which extends eastward a snowy range, numerous peaks in which were fixed by the Pundit, along a length of 180 miles, up to where the range terminates in a mass of peaks called Gya'kharma, which also lie to the south of and very near the Pundit's road. . . . This range is probably not the watershed between the basin of the Brahmaputra and the lake country of Hor, for the Pundit was informed that to the south of the range, running parallel to it, is a large river, the Dumphu, or Hotá Sangpo, which ultimately changes its course and flows northwards into the Kyaring lake. . . . (p. 110) The largest river crossed by the Pundit in this section of his travels was the Dumphu, or Hotá Sangpo, which receives the drainage of the southern slopes of the Targot-Gya'kharma range of mountains, and flows into the Kyáring Cho, forming one of the numerous sources of the Nák-chu-khá."

The Targot Lha is identical with Targo-gangri, a magnificent snow massif standing south-east of Dangra-yum-tso, and with its northern extremity reaching to the very shore of the lake. There may, of course, be a Targo-la also somewhere in these mountains, but the complex is perfectly isolated from the range to the east, upon which Nain Singh found the peaks of Gya'kharma. He is quite right in saying that this range, culminating in Gya'kharma is not the watershed between the Brahmaputra and the lake region, which I have called the "Central Lakes of Tibet." I have already mentioned above that the information the Pundit got about Dumphu or Hota-Sangpo is quite wrong, which I was able to control very closely when I crossed the unknown region from Ngangtse-tso to Ye-shung on the Brahmaputra. From the head range of Trans-Himalaya the water goes north to the lakes, Targo-tsangpo, Tagrak-tsangpo, Bara-tsangpo, Ota-tsangpo, etc.,† and those rivers break through the range, which he calls the Targot-Gya'kharma range, in transverse valleys; to the south all the water goes to My-chu-tsangpo, which is a tributary to Raga-tsangpo, and one of the greatest of the tributaries which reach Brahmaputra from the north. The range, which is a continuation of Targo-gangri, goes to the south-west, west, and north-west, and forms here the main watershed, and I crossed it at Sangmo-bertik-la in May, 1908. South of Kyaring-tso the main watershed is situated considerably south of the Targot-Gya'kharma range; the pass Khálámba-la of the G.T.S. explorer of 1872 gives an idea of the situation of the great watershed in this part of Tibet, and as a matter of fact Khálámba is situated in the range which is the immediate south-west continuation of Nien-chen-tang-la. About this range Markham says,‡ "Great Tibet . . . (is bounded) on the north by another lofty range, called by Hodgson the Nyenchhen-thánglá chain, which separates the country of villages and cultivation from the nomadic hordes on the still loftier plateau of lacustrine drainage between that chain and the Kuen-lun."

Godwin Austen says in his article, "The Mountain Systems of the Himalaya," etc., p. 86 §, "I leave it to future travellers and those who know the country, to work out this subject still further and with greater exactness, and after a closer examination of the country than I was ever able to give it; and I leave it especially to those who may have the good fortune to visit the middle and eastern portions of the Himalayas, and that great *terra incognita* beyond." On p. 87 he mentions

* *Journal* of the R.G.S., vol. **47** (1877), pp. 86 *et seq.*

† For the last two mentioned Nain Singh has Pára and Hota.

‡ 'Travels in Great Tibet,' etc., *Proceedings*, vol. **19**, 1874, p. 327.

§ *Proceedings*, vol. **6**, 1884, pp. 83 *et seq.*

Mr. Trelawnay Saunders' Aling Ganghri, or his own Trans-Indus extension, and he continues, "It is then carried south to unite with the high range north of the Manarasowar lake, and is there continued east as a range north of, and parallel with, the Sangpo. It is unnecessary to define it further, for the topography does not exist from which we can lay down such lines."

Thus Godwin Austen, in 1884, calls the country north of the upper Brahmaputra a *terra incognita*, and says that the topography does not exist from which we could be able to lay down the watershed. And so it remained, until I succeeded in crossing the watershed in this very region by seven different passes, to which are to be added three more further west, one of which had been crossed by Calvert only, the two others by many travellers. So for the Trans-Himalaya, the lines laid down upon Godwin Austen's map, illustrating his article, are hypothetical, and of no real scientific value. Here, in Trans-Himalaya, he includes the northernmost water-dividing range of the Himalayas, and all the ranges between the upper Brahmaputra and Nain Singh's route, and joins together ranges of three different mountain systems under one general name. But it may be that he puts into Trans-Himalaya the same meaning as Montgomerie obviously does—namely, all the mountains and regions which are situated on the other side of the Himalayas, and only under such conditions the name of Trans-Himalaya could be used at a time when nothing was known of the topography and orography, and when the country was a real *terra incognita*. On his map, Godwin Austen has also marked with a dotted line the "Gangri of Mr. T. Saunders," which is meant to be the chief watershed. It is, of course, simply hypothetical, and only for the part south of Tengri-nor, Nien-chen-tang-la, correct; all the rest is wrong.

During his remarkable journey of 1879–82, the famous Pundit Krishna* must have crossed the eastern part of Trans-Himalaya at least twice, but I cannot make out now whether his passes Koli-la and Nub-Kong-la are situated in the water-dividing range or in ramifications.

It is remarkable how very meagre the Society's publications are in matters Tibetan. Only occasionally one comes across an article about a journey or about some special item of this interesting country. One of the most interesting articles is written by Tanner, under the title of "Our Present Knowledge of the Himalayas."† Here we find the following truth: "I here remark that the moot question as to whether the Sutlej actually issues from the Manrasowar lake or not, does not appear to have been definitely settled, though controversies have been raised on the point, and notwithstanding that more than one Englishman has actually been along the supposed bed as far as the lake." To this I will only remark that, during my long stay at Tso-mavang and Langak-tso, I was able to solve this problem definitely, and to add a good deal of direct observation material to the excellent work of Ryder and Rawling's expedition.

After the interesting paper of Captain (now Colonel) Bower, "A Journey across Tibet,"‡ we find the following remarks by Delmar Morgan: "The paper we have listened to is one not only of great geographical interest, but of great importance, because it shows what may be done by a European in the Trans-Himalayan country. It has been stated, and frequently reiterated, that access to these regions is impracticable, owing to the obstinate exclusiveness of the natives or their rulers, and that if it is to be explored at all in the interest of science it must only be by trained native surveyors. I have always been of opinion, and have before remarked here,

* Walker, "Four Years' Journeyings through Great Tibet," etc. *Proceedings*, vol. 7, 1885.

† *Proceedings*, vol. 13, 1891, pp. 403 *et seq.* ‡ *Geogr. Journ.*, vol. 1, 1893, p. 406.

that these natives, however valuable some of their work may be, and however carefully trained in the use of instruments, cannot bring us that accurate information as to these countries which we require. They seem to lack that spirit of critical inquiry, and that fertility of resource, that distinguish the European traveller. . . ."

I quite agree with Morgan: the work of native explorers is not sufficient from a scientific and critical point of view, but as pioneers they have almost always proved to be admirable, and in some cases we have had to be indebted to them during some forty years for all our knowledge of certain parts of Tibet. In his "Note on the Royal Geographical Society's map of Tibet,"* General Walker says, "On the south the information has been wholly taken from the Trans-Himalayan operations of the native explorers attached to the Indian Survey . . .;" and to this Major Ryder adds,† "Our knowledge of the country lying between our frontier and Lhasa depended chiefly on the surveys executed by different explorers trained by and working under the supervision of officers of my department—the Survey of India. They worked under extraordinary difficulties, and in great danger of their lives; that, when at last we have been able to carry through a regular and systematic survey of the country, we have not been able to find that the rough maps prepared from these explorers' surveys were in any important points other than very fairly accurate, reflects the very highest credit on these men, notably the late Pundit Nain Singh and the explorer A.K." I have already stated my opinion of the Pundits, and I should like to point it out in the following way: Their topographical work is excellent in giving us a rough idea of the country; the information they have gathered from the natives is almost worthless, and the result of their different journeys can hardly be used for scientific purposes.

In the above quotations it is interesting to note that Morgan talks of the "Trans-Himalayan country," and Walker of the "Trans-Himalayan operations." The word Trans-Himalayan is thus very vague and diffuse; everything beyond Himalaya seems to be Trans-Himalayan country—operations and explorers.

From the last ten or twelve years I have picked out of the *Geographical Journal* some more quotations on the parts of Tibet which I have explored. In the description of his journey, Littledale says,‡ "On the south it (Nam-tso) was fringed by the magnificent range of the Ninchen-Tangla—a succession of snow-clad peaks and glaciers, partially hidden in clouds and vapour, which added to their size and grandeur; while above all towered, with cliffs of appalling steepness, the great peak of Charemaru, 27,153 feet." Littledale crossed this part of Trans-Himalaya by the pass Guring-la.

Speaking of Tso-mavang and Langak-tso, Holdich says,§ "We are indebted chiefly to the brothers Henry and Richard Strachey for our mapping of the two lakes, and those gentlemen are the authorities for that connection between the lakes which is shown in some maps, and should be shown in all." And Richard Strachey himself says,‖ "From the height to which we climbed we looked down on the stream that connects Manasarowar and Rakas-tal." In the summer of 1907 and in the summer of 1908 there was not the slightest visible connection between the two lakes. I will try later on to point out the cause of the very different information of different travellers on this subject.

Again a quotation from Holdich:¶ "Meanwhile, there is no more promising field still open to the *bonâ fide* explorer than that of Tibet and the farthest ranges of the Himalayas. Few people are aware how vast an extent of the Himalayan

* *Geogr. Journ.*, July, 1894.
† *Ibid.*, October, 1905, p. 369.
‡ *Ibid.*, 1896.
§ *Ibid.*, 1898, p. 588.
‖ *Ibid.*, **15**, 1900, p. 395.
¶ *Ibid.*, **20**, 1902, p. 415.

area still remains untrodden by any European." In connection with this I must quote what Sir Clements Markham said after Littledale's paper:* "I am sorry to say that on the map we have to-night that chain of mountains does not appear, which only shows how important it is that further exploration should be conducted in Tibet. I have called that range the northern range of the Himalayan system. I remember Mr. T. Saunders was anxious to name it, and he has done so on a map he drew for me, the Gangri range, after the knot of peaks which connects it with the Karakorum; but B. Hodgson has called it the Nyendim-tang-la, as does also Mr. Littledale himself. These mountains are of the greatest possible importance and interest; they have only been crossed by native explorers and by Mr. Littledale opposite the Tengri-nor, and in the whole length from Tengri-nor to the Mariam-la pass no one has crossed them, so far as we know. One of the last suggestions by General Walker was that a rough survey should be undertaken of these northern parts of the Himalayan system, and I believe that nothing in Asia is of greater geographical importance than the exploration of this range of mountains, which I trust geographers will agree to give some name to. . . ."

Another President of the Royal Geographical Society has been aware of the great necessity to explore the unknown parts of Tibet, namely, Sir G. Goldie, who says in his "Address to the R.G.S., 1906,"† "To us, as British geographers, it is somewhat tantalizing that the British Government has declined to grant permission to experienced British officers to enter Tibet or to explore the unknown reaches of its great rivers; but this is not the place for either approval or condemnation of the policy on which this decision is based."

I now come to Ryder's most interesting paper on the "Exploration and Survey with the Tibet Frontier Commission, and from Gyangtse to Simla *viâ* Gartok."‡ On p. 387 he says, "We now followed the river (Brahmaputra) valley for a week or so, always in the same large plains, until we could see the watershed range ahead of us, from the valleys of which innumerable streams issue to form the Tsangpo, the largest coming from a snowy range to the south-west." From this one gets the impression that this largest stream was regarded as the source branch of the Brahmaputra, but a few lines lower down, on crossing Mayum La, Ryder says, "We had now finished with the Tsangpo, having surveyed it from Shigatse to its source," whereby Maryum-chu, coming from that pass, seems to be regarded as the source branch. And this view is also emphasized on p. 390, where Ryder gives the following *résumé* of his and his comrades' work: "We surveyed the Tsangpo from Shigatse to its source, surveyed the Mansarowar lake region, and settled the doubtful points connected with it, which have been the subject of much discussion; we completed the survey of the Sutlej river from its source to where it enters British territory, and surveyed the source of the Gartok branch of the Indus." So from this it is not quite clear which branch Ryder regards as the real source of the Brahmaputra. And this fact gave me the idea of visiting the real source, as I had Ryder's paper with me. In an article§ on my last journey, Ryder says, "Sven Hedin also visited and surveyed the true source of the Brahmaputra. This, however, had been approximately located—I think by Nain Singh—and fairly well surveyed by Rawling and myself, though Sven Hedin, having actually visited the real source, his map will be more accurate."

It is of no very great importance, really, if you call my journey to the true source of the Brahmaputra a discovery or not, but the fact will always remain that even the few Europeans who have ever been in this part of Tibet before me

* *Geogr. Journ.*, vol. 7, p. 482.
† *Ibid.*, vol. 28.
‡ *Ibid.*, vol. 26, 1905, pp. 369 *et seq.*
§ *Ibid.*, vol. 32, December, 1908, p. 590.

sometimes call one branch, sometimes another, "the source of the Brahmaputra"; and that nobody knew whether the river originated from one or several glaciers, or from a glacier lake, or whatever it was like. I gave myself the trouble to measure with boat and instruments the volume of water in all the upper branches, and, finding the Kubi-tsangpo 4½ times as big as the Mariyum-chu, I followed the Kubi-tsangpo up to a point where it is formed by two rivers, the biggest of which is still called Kubi-tsangpo. Then I followed this river further up to the very front of three great glaciers, all of them having different names, and the westernmost being the real source of the Brahmaputra. All this was new to geography, as neither Nain Singh nor any of the members of the Gartok mission had ever been up the Kubi-tsangpo; approximate discoveries, which are not made on the very spot, are not sufficient, at least not from a scientific point of view.

As to the Mansarowar problem, and the problem of the real or genetic source of the Sutlej, I do not quite agree with Ryder—or rather, I believe I have added some more points of view to his very excellent and careful observations. I regard the source of the comparatively big south-east river, Tagi-tsangpo, as the source of the Sutlej, at any rate as one of its sources, if the three rivers from Trans-Himalaya, which join the Sutlej a little above Tirtapuri-gumpa, also are to be regarded as source branches—and this must be a question of the volume of water as an average of the whole year. But as these three rivers are more temporary, depending upon the season of the year and upon the rains, whereas the effluent from Rakas-tal is constant, although underground, I regard the Tagi-tsangpo, the greatest river falling into the Mansarowar, as the real genetic source.

At this conclusion we can arrive only by measuring all the rivers falling into the two lakes, and I have measured every one of them; and at the source of the Tagi-tsangpo no European or native explorer had ever been before, and on Ryder's map this river is, in its upper part, marked with a dotted line, although this line goes a little too far to the east. Ryder gives a very complete and correct history of the hydrography of the lakes as given by different travellers, and he himself found that Strachey was quite correct. "No water was flowing at this time of year, but the local Tibetans all agreed that for some months in each year there was a flow during the rainy season and the melting of the snows, *i.e.* about from June to September. As a rise of about 2 feet in the level of the lake would cause water to flow down the channel, this appears quite worthy of belief." Now this is different in different years. In 1907 not a drop of superficial water went from Mansarowar to Rakas-tal, which may have depended upon the fact that that year almost no rain at all fell in this part of Tibet. In 1908 a good deal of rain fell, but on account of the preceding year being so dry, it had no force to swell the Mansarowar sufficiently to cause some superficial effluent. But the underground effluent continues even in dry years. In the summer of 1904, however, that is to say a few months before Ryder's visit, there was really a superficial effluent from Mansarowar, as the lamas of Tiju-gumpa told me, and this temple is situated on the northern bank of the channel, just above the bridge which still crosses the bed, and is in a very good state of repair. Many Tibetans told me they remembered very well the days when it was impossible to cross this effluent on horseback, and the existence of the bridge proves that they are right.

As an addition to Ryder's history of visits and views about Mansarowar, I may add the following from Pearse's article on "Moorcroft and Hearsey's visit to Lake Mansarowar."* "Mr. Moorcroft . . . found reason to believe that the lake has no outlet. His stay, however, was too short to allow of his making a complete circuit of it; and adverting to the difficulty of conceiving the evaporation of the lake's

* *Geogr. Journ.*, vol. 26, p. 182.

surface in so cold a climate to be equal to the influx of water in the season of thaw from the surrounding mountains, it may be conjectured that, although no river ran from it, nor any outlet appeared at the level at which it was seen by Mr. Moorcroft, it may have some drain of its superfluous waters when more swollen and at its greatest elevation, and may then, perhaps, communicate with Rowan lake, in which the Sutlej takes its source (!), conformable with the oral information received by our travellers."

Hermann von Schlagintweit takes the following perfectly correct view:* "Die ganze breite Stelle zeigt sich am unteren Ende als eine flache Senkung gegen Westen, versumpft, mit zahlreichen Wasserpfuhlen, deren Anordnung allerdings ganz gut damit sich verbinden lässt, dass, nach Angabe der Eingebornen, zur Zeit des Hochwassers periodisch ein normales Abfliessen hier stattfindet, also eine Ausdehnung des Sutlejbettes bis zu diesen Seen." To this I would only remark that the connection of the lakes with the basin of the Sutlej is not periodical, but permanent.

To the problem of the hydrography of the Mansarowar, Mr. Savage Landor gives this extraordinary contribution:† "It was my good fortune to make quite sure from many points that . . . the ridge between the Rakas and Mansarowar lakes is continuous, and no communication between the two lakes exists. With the exception of a small depression about halfway across, the ridge has an average height of 1000 feet all along, a fact which ought, in itself, to dispose of the theory that the two lakes are one. I also further ascertained from the natives that there is no communication whatever between them, though the depression in the ridge makes it probable that at a very remote period some connection existed. The lowest point in this depression is over 300 feet above the level of the lake." This is very curious, considering the fact that Ryder gives 2 feet only as the lowest point in the depression, which is about the same as I found.

Mr. Sherring says,‡ "It is a fact that at this present moment (1905) no water is actually flowing between the two lakes, the reason being that storms blowing from the east have thrown up sand at the mouth of the passage to a height of about 4 feet, but the best native information on the spot gives it as a fact that after heavy rains the water traverses the channel. The last occasion was eleven years ago, when exceptional rain fell, and there were floods, accompanied by great loss of life to cattle." And later on he has this very interesting communication:§ "The actual source of this river (Sutlej) is at the monastery of Dalju (Dölchu-gunpa), where there is a large spring, though a dry channel is continued up to the Rakas Tal, and in places in this channel water is found. The local statements all agree in asserting that there is an underground flow of water throughout the entire length of this dry channel, which occasionally comes to the surface, only to disappear later on. There can be no doubt that during a season of very heavy rain and floods this dry channel would connect the source at Dalju with the Rakas Tal."

The lamas of Dolchu told me that the spring was about the same the whole year round, but it is interesting to find, through Mr. Sherring, that even some of the natives seem to have found out the right explanation.

The following is what Captain Rawling says in his very excellent book about his different journeys in Tibet:‖ "Many have supposed that the Sutlej runs from this lake (Rakas Tal), and as Rakas Tal and Manasarowar are connected, it

* 'Reisen in Indien und Hochasien,' vol. 3, p. 58.
† 'In the Forbidden Land,' vol. 1, p. 257.
‡ 'Western Tibet and the British Borderland,' p. 272.
§ *Ibid.*, p. 284. ‖ 'The Great Plateau,' p. 259.

stands to reason that the Sutlej would actually originate in one of the streams that run into Manasarowar lake. To settle the question as to whether such was the case or not, Ryder and I set out at dawn the following morning with two local guides. We travelled first in a southerly direction in search of the channel, and this was eventually found some 2 miles further away than anticipated. The passage was broad and dry, and the level of the lake many feet below the bed of the channel. It was evident that no water had flowed from Rakas Tal down the passage for a considerable time, but there was nothing here to prove that such might not be the case during the melting of the snows in an exceptionally wet season. The guides and the shepherd whom we met stated that no water at the present time ever flows out of Rakas Tal, but added that during the Nepal war, about fifty years previously, the overflow took place annually. To make quite sure, we entered the channel and moved along it in a westerly direction. At places the bed widened considerably, and the dry ground was covered with a thick encrustation of salt; such would not have been the case had water flowed over it during the last few years. When 5 miles distant from the shore, we obtained from the sand-marks in the bed of the stream conclusive proof that the Sutlej rises a few miles to the west of the lake, for their arrangement indicated that at one place the rain-water, draining from the adjacent hills, runs eastwards towarde Rakas Tal, whilst a little further on other streams entering the channel flow in a westerly direction, and form the source of a river. Rakas Tal, like most Tibetan lakes, is said to be steadily diminishing in volume, and it is therefore more than probable that this sheet of water will never again overflow into the channel of the Sutlej."

My own observations during visits to the dry bed in 1907 and 1908 agree in every single detail with Rawling's, although I explain the hydrographical arrangement in a different way from him. He says that the object of his and Ryder's visit to the bed was to settle whether one of the streams that run into Mansarowar could be regarded as the source of the Sutlej or not, but that the result was that the Sutlej rises a few miles to the west of the lake. I have already shown above that I regard the Tagi-tsangpo running into the Mansarowar as the real source of the Sutlej. Rawling quite correctly observes that Rakas Tal is steadily diminishing in volume, which is also perfectly correct and obvious. But if the lake has no outlet at all, and if the evaporation alone was stronger than the influx of fresh water, and if the lake in this way was constantly diminishing in volume, it would necessarily become more and more salt year by year. I have already pointed out that the fact that the water is absolutely fresh all over the lake is proof sufficient that it must absolutely have an underground effluent, which does, however, not need to be very considerable. Above Dolchu-gunpa's big spring there are several perfectly fresh springs in the bed, which all must come from the lake alone. But as soon as the level of the lake in future shall have reached some layer of impermeable clay, this effluent will die out and the lake will become salt, and, like Panggong, cut off from the system of the Sutlej. I cannot possibly enter now upon all the details and all my different observations and measurements in connection with this most interesting and beautiful problem of physical geography, but in the near future I hope to get an opportunity to lay them all before the geographical world.

Finally, a quotation from Holdich's excellent book:* "The Indus rises on the slopes of Kailas, the sacred mountain, the Elysium or Siva's Paradise of ancient Sanskrit literature. Its long and comparatively straight course from its source at 16,000 feet above the sea, through channels running north-west through gigantic mountains, is often comparatively placid. . . . The Sutlej rises on the southern

* 'Tibet, the Mysterious,' p. 12.

slopes of Kailas. It flows no longer from one of the sacred lakes of Manasarowar, famous in Hindu mythology. Abandoning its ancient cradle in Rakas-tal, it now issues from the foothills of Kailas." Several of the above quotations show that this has been generally adopted amongst British geographers. But, as a matter of fact, the Indus rises by no means from the slopes of the Kailas, and only one of the tributaries of the Sutlej rises from the southern slopes of the Kailas. Even from the northern slope of the Kailas, from Diripu-gunpa, one has to ride one day's march to the north-north-east, to the source of another tributary of the Sutlej. Mount Kailas is thus altogether situated within the domains of the Sutlej, and the Indus has absolutely nothing to do with Mount Kailas. This proves how very little was known about the situation of the source of the Indus. And even so late as in 1905 Rawling writes about the same question,* "Formerly the main river (of the Indus) was supposed to originate from these small streams, but the Pundit Nain Singh proved, about fifty years ago, that they form but a large tributary which joins the main branch a few miles below Gartok. The Pundit was only able to follow up the latter for a few miles, *so the actual whereabouts of the source of the Indus is still unknown*, though the natives assert that it rises from the northern slopes of Kailas Parbat."

So the confusion about the situation of the source of the Indus was still greater than that about the source of the Brahmaputra. Holdich says,† "As has already been pointed out, the Brahmaputra and the Indus start from nearly the same point, the intervening watershed between their sources being called the Mariám La, in about east longitude 82°, not very far east of the Manasarowar lake." But, as a matter of fact, the Maryum-la is simply a watershed between one tributary to the Brahmaputra, namely, the Maryum-chu, and the Gunchu-tso, which is a self-contained salt lake. Holdich has obviously adopted Ryder's view of making the Maryum (= Mayum)-la, or rather the Maryum-chu, the source of Brahmaputra. On p. 265 he says, "Rawling and Ryder have lately completed a valuable geographical survey of all this country, from Gartok on the Indus to the sources of the Brahmaputra, and from those sources to the city of Lhasa." And again, on p. 296, he has a similar expression.

In his article about my fifth journey, Ryder says,‡ "The geographical results of his journey may be summed up as follows:—

"(1) The discovery and careful exploration of the Trans-Himalaya range, and the filling in of the large white space on our maps north of the Brahmaputra from Gartok to Shigatse, and the discovery of the provinces of Bongba and Chokchu, which he has been the first to discover, that of Dokthol, on the map, not being in existence.

"(2) The discovery and exploration of the source of the main branch of the Indus.

"These, I believe, are two absolutely new and most valuable discoveries."

It is too much to speak of my discovery of Trans-Himalaya. I myself have put it in the following way in the telegram which was sent to the *Times* by Mr. Hensman in Simla:§ "Dr. Sven Hedin sums up the results of his explorations as follows: My great discoveries are—first, the true sources of the Brahmaputra and Indus, and the genetic source of the Sutlej east of Mansarowar lake. Secondly, the exploration of Bongba, which I traversed twice by different routes. But the greatest of all is the discovery of that continuous mountain chain which, taken as a whole, is the most massive range on the crust of the Earth, its average height above

* 'The Great Plateau,' p. 269.

† 'Tibet,' etc., p. 233.

‡ *Geogr. Journ.*, December, 1908, p. 590.

§ *Times*, September 18, 1908.

the sea-level being greater than that of the Himalayas. Its peaks are 4000 to 5000 feet lower than Mount Everest, but its passes average 3000 feet higher than the Himalayan passes. *The eastern and western parts were known before, but the central and highest part is in Bongba, which was previously unexplored.*" And in the lecture which I gave at Viceregal Lodge on September 24, I gave the history of all the exploration in the western and eastern parts of the Trans-Himalayas, and summed up in the following conclusion: "Even if certain parts of it were known before, Trans-Himalaya as a whole geographical unity is a new conquest on our Earth, a new geographical region and signification, that has been more neglected than even the moon, and now it will be introduced for ever and evermore into the geographical literature." As to the name, I compared it with such significations as Transcaspia, Transcaucasia, Transoxiana, Transbaycalia, Transilenian Ala-tau, Transalai, and others. I have referred above to the name of Trans-Himalaya. Cunningham subdivided North-Western Himalaya into three main ranges—Trans-Himalaya, between Sutlej and Indus, Bara-lâtsha range, and Pir-Panjal range. The word was used by Montgomerie, Godwin Austen, and others for everything situated to the north of Himalaya, and so it is also used by Holdich, who says,* "One of the earliest (Pundit explorations) was also one of the best, for it opened up to us a new era in Trans-Himalayan knowledge." And on p. 232, he talks of "the Trans-Himalayan explorer." It again appears in David Fraser's 'The Marches of Hindustan, the Record of a Journey in Thibet, Trans-Himalayan India, Chinese Turkestan, Russian Turkestan, and Persia.' I will also mention in this connection that in a letter to me, Prof. Supan has preferred the name Anti-Himalaya, a name which also appears in *Petermanns Mitteilungen*. But as the name Trans-Himalaya has tradition for it in the history of Indian exploration, I think it may be regarded as preferable, especially as the Viceroy of India has approved of it.

Even long before my exploration of the unknown country north of the upper Brahmaputra, any one could easily understand that there must exist *somewhere* a northern watershed of the great Indian rivers. The journey of Nain Singh in 1874 drew this problem a great step forwards, as he passed several self-contained salt-lakes, and somewhere between them and the northern tributaries of the upper Brahmaputra, there must, of course, exist a chief watershed. On several rather old maps attempts have been made to put in this watershed, as, for instance, in Markham's 'Narratives of the Mission of George Bogle to Tibet,' and of 'The Journey of Thomas Manning to Lhasa,' where we find a map drawn by Mr. T. Saunders, and on this map we find a tremendous range called Gangri mountains, as forming the watershed. If this range, which was entered also upon Godwin Austen's above-mentioned map, had had any foundation in real exploration work, we should never have needed to visit the country north of the upper Brahmaputra any more, but unfortunately it is perfectly fantastical and utterly wrong, and belongs to that category of geographical discoveries which are accomplished at the writing-table at home. It has the same value as the tremendous range on the same map which runs north-east from Tengri-nor, and does not exist in reality, or as the information "Turki tribes" in the very heart of Tibet. The Gangri mountains of Saunders are drawn as *one* continuous range or chain. In reality the Trans-Himalayan system consists, in its central part, of at least ten different ranges, to which I have given different names, and several small ranges. Through this orography the curious arrangement results that the watershed of Northern India runs over from one range to another, and very often is situated in a latitudinal valley between two ranges. Nobody had ever suspected, and for my own self I

* 'Tibet,' etc., p. 228.

had never believed, that the orography of this part of Tibet would be so extremely complicated as it has proved to be. The Gangri mountains of Saunders are broken through by the Charta-tsangpo in a transverse valley, a mistake which we find still on the R.G.S.'s map of Tibet, published in 1906. The Charta-tsangpo begins on the southern slopes of Trans-Himalaya in several small branches which all run into the lake of Lapchung-tso, from which the main branch of Charta (or rather Chaktak) tsangpo issues.

On map 8 of vol. 1 in his great work, 'China,' Baron Richthofen has three ranges north-east of the upper Indus and upper Brahmaputra, and here we find the names Aling-gangri, Karakorum, and Kailas. On the map No. 69 (p. 690) in vol. iv. of my 'Scientific Results,' I have marked out two hypothetical ranges in the unknown country north of Tsangpo. I supposed that between them was a chain of self-contained lakes, to which "Ghalaring-tso" and the Mun lakes belonged. The northern range I regarded as a watershed to the central lakes, discovered by Nain Singh, the southern as the watershed of the Tsangpo. During my last journey I have been able to prove that this hypothesis was utterly wrong.

I must mention also a few points from that most valuable and excellent work of Colonel Burrard and Dr. Hayden, entitled 'A Sketch of the Geography and Geology of the Himalaya Mountains and Tibet.' On the frontispiece map to vol. 1 we find the Kailas range running between the two branches of the Indus, and north of the upper Brahmaputra, and joining the Nien-chen-tang-la. I have no time now to enter upon a discussion of Burrard's views, which I find extremely hypothetical for that part of the hitherto unknown country which I have crossed. Mr. Longstaff* says, "This ('Kailas range') is obviously the Trans-Himalayan system under discussion," and Colonel Burrard says of it (p. 95), "Trigonometrical observations show that it joins with a range of Tibet, known as the Ninchinthangla, in long. 88°, a point which Dr. Sven Hedin himself fully confirms." But Colonel Burrard also says, on the very same p. 95, "East of Manasarowar the Kailas range forms generally the northern rim of the Brahmaputra's trough; it cannot, however, be called the water-parting, as it is cut through in places by rivers from the north." Now, the Trans-Himalaya is nothing else than the very water-parting of the Brahmaputra trough, and thus it cannot possibly be the same as Burrard's Kailas range, as Mr. Longstaff professes to have discovered. And when he then says, "The absolutely new section of this range cannot, therefore, be taken as more than the distance between 135° W. (29° 55′ 16″ N., 84° 33′ 33″ E.) and the easterly extremity of the Kailas group in the vicinity of Mariam La, a distance of about 100 miles," I will remind him of Markham's words after Littledale's paper, "In the whole length from Tengri-nor to the Mariam-la pass no one has crossed them, so far as we know, . . . and I believe nothing in Asia is of greater geographical importance than the exploration of this range of mountains." In fact, the hitherto *absolutely unknown* part of the Trans-Himalaya which I have explored is exactly 500 miles long. But the most amusing of all is when Mr. Longstaff tells the readers of the *Geographical Journal* that Atkinson's and my own maps of Trans-Himalaya are "practically identical," regarding the fact that Atkinson has never been in Trans-Himalaya, and I have never published my maps. It is not sufficient to quote sources which have no foundation in reality. So Colonel Burrard says:† "The question may be asked whether the snowy range seen by Nain Singh to the south may not have been the Kailas range. The answer is that the snow peaks fixed by Nain Singh stand 120 miles north of the Brahmaputra,

* *Geogr. Journ.*, January, 1909, p. 97.

† *Ibid.*, p. 112.

and many miles north of any known peaks of the Kailas range. Thus the Aling Kangri peaks east of long. 81° are 100 miles north of the sacred peaks of Kailas. In long. 85° the two ranges are 100 miles apart, and in 36° N. 80 miles. The interval, in fact, between Nain Singh's range of peaks and the Kailas range is greater than between the Kailas and Ladak ranges, and if we have regard to the spans of the known ranges of the Himalaya and Karakoram, we find it more reasonable to assume that an intermediate trough separates Nain Singh's range from the Kailas than that the two apparent chains of mountains are the respective flanks of one broad range." In reality there *is* only one water-parting range, or rather system, although, as I have said before, there is a labyrinth of different ranges. But this uncertainty proves how little we really knew of the country. On Chart XVII. in his work, Colonel Burrard has left a tremendous gap between the Xinchin-thang-la range and the ranges in the far west of Tibet. This is right, as nothing was known of the geography here. On his Chart XXX. the northern water-shed of the Tsangpo ought to be removed some 50 miles further north, between long. 84° to 89°.

How little we really knew of the country north of the upper Brahmaputra I have shown in several of the above quotations. One of the greatest authorities upon the geography of southern Tibet, Captain Rawling, wrote to me, when I was in Shigatse, and expressed the theory that the northern tributaries of the Tsangpo came from the central lakes, discovered by Nain Singh. And exactly the same hypothesis is advanced by Holdich in his book, which was published *after* Rawling's and Ryder's journey:* "Judging from the great size of these northern tributaries, and the number of them, there certainly seems good reason for supposing that part of the central lake district lies within the Brahmaputra basin. There is no other way of accounting for their volume." Speaking about Littledale's route, Holdich says† that it was "probably near the northern rim of the Brahmaputra basin; . . . the fact that no large rivers are crossed seems certainly to indicate that it is here, or near here, a little to the south, that the northern watershed of India is to be found. *From some of the innumerable lakes it is probable that those big affluents of the Brahmaputra noted by Nain Singh must take their rise;* but intermediate to this long line of route through the central Chang and that of the Brahmaputra river, no traveller has yet contributed the necessary topography to enable us to decide with certainty." And, finally, Holdich says‡ about Ryder, "It seems unlikely that he has established the position of that dividing line between the central lake region and the Brahmaputra basin, one of the most important geographical features in Asia." So even those men who had specially studied the geography of southern Tibet believed that the central lakes drained to the Brahmaputra. In reality, those lakes are self-contained, and, with two exceptions, salt. And instead of rivers streaming from them to the Tsangpo, we find between them and the upper Brahmaputra the most massive and gigantic mountain system in the world, the volume of solid stone of which must be more considerable than that of Himalaya.

On Colonel Burrard's Chart XXII., published in 1907, we find a very clear and up-to-date map of "Routes of Explorers in Tibet, 1865 to 1905." Between long. 81° and long. 89° and on both sides of lat. 33°, we find a perfectly white patch, about two degrees broad. All explorers who have been in Tibet, including "The Trans-Himalayan explorers," have carefully gone round it, as if they would purposely avoid it. And the very same white patch we find on "Tibet and the Surrounding Regions" of 1906. I have been happy enough during my last expedition to fill it up with the main northern watershed of India, with mountain ranges, rivers, lakes, temples, tribes, and roads, and to follow and map all the chief geographical lines of

* *Geogr. Journ.*, January, 1909, p. 234. † *Ibid.*, p. 284. ‡ *Ibid.*, p. 296.

this white patch, on which only one single word had been perfectly correct, namely, the word *Unexplored*.

The following communications from Sir Clements Markham and Sir Thomas Holdich were read:—

Sir CLEMENTS MARKHAM: No one can read Dr. Sven Hedin's paper on "Discoveries in Southern Tibet" without being struck by the exhaustive character of his researches. In combining this essential part of an explorer's equipment with his qualifications as a surveyor and observer, I look upon Sven Hedin as the *beau ideal* of a Victoria Medallist, most fully complying with all the conditions laid down in the Council Minute by which it was instituted.

The so-called Nien-chen-tang-la mountains were unknown from the Tengri-nor to the Maryum-la pass, and I always looked upon their discovery, on those meridians, as the most important *desideratum* in Asiatic geography for many reasons. I now hail Sven Hedin as the discoverer, and I think that his name of Trans-Himalaya is the best and most convenient that could be adopted.

He also is undoubtedly the discoverer of the true source of the Brahmaputra, and his journey with this object strikes me as a most painstaking and accurate piece of geographical work. His discussion of the question of connection between Mansarowar and Rakas-tal is very interesting and instructive, but I am unable at this distance from means of reference to offer any remarks upon it, or upon the question of the source of the Sutlej. His paper is sure to give rise to an important discussion.

Sir THOMAS HOLDICH: I do not like the term "Trans-Himalayas" for several reasons. In the first place, it is not a name at all. Of course, Sven Hedin's mountains *are* Trans-Himalayas—that goes without saying; but why print such an obvious fact on the map? In the next place, the expression is not new—it is very old indeed, and has been applied for years to the mountain region (Trans-Himalayan) in the extreme north of Kashmir, including the Mustagh range from which the Hindu Kush takes off, the Karakoram, etc. So that, as Sven Hedin admits, the term Trans-Himalayas (why not put it in English—"beyond the Himalayas"?) would extend from the Hindu Kush to the Salwen, and would not be in the least distinctive of his *Trans Tsangpo* section of the system or "cordillera." The Indian Survey Department would no more think of printing "Trans-Himalayas" or "Beyond the Himalayas" across such an extent of Asia, than they would put "Beyond the Indus mountains" from near Karachi to Buner. Besides, it is only "beyond" from the Indian point of view. I cannot say that I remember the expression "Trans-Caspian" or "Trans-Indus" or "Trans-Himalayan" in our maps, though, of course, they are all convenient geographical definitions when writing. Trans-Alai, I believe, has got crystallized, but I always regarded it as a foolish definition due to the fact that no one had taken the trouble to find a name locally. Are those mountains "Trans-Alai" for India, by the way? I am not sure that they are not *Cis*-Alai. In naming the various sections of the one great, long-extended system or "cordillera," which begins with the Hindu Kush and ends in the west of Persia (or beyond), we always adopted such local names as we could find. If the mountains had no name, we took the name of the district. In the case of the Trans-Tsangpo, part of this Trans-Himalayan system, I think, Sven Hedin has the right to suggest a name, and he has already given a name to a large district in that white space of our Tibetan maps which we look to him to fill up. That name is Bongba. Why not apply it to that section of the Tibeto-Trans-Himalayas which forms the northern divide of the Brahmaputra? It is easy to remember, and we should know what we mean when we talked of the Bongba mountains,

which we certainly shall not know if we talk of Trans-Himalayas. Has the India Survey Department (which publishes the map of this part of Asia) been asked what they think about it?

Colonel GODWIN-AUSTEN: It is now forty-six years since I was in the Pangkong district of Ladak,* and took a last longing look from a high point near Radok to the eastward, over the flat-looking broad belt of elevated country stretching to the eastward, dotted with small lakes, and bounded by a snowy range on the south, the Aling Kangri of the Royal Geographical Society map. Dr. Sven Hedin often refers to the white patches on that map of 1906, but to me, looking back to their size in 1863, it is wonderful what an enormous amount of topographical information has been accumulated in the interval; a very large amount of this work has been executed by Dr. Sven Hedin. I congratulate him sincerely on having done it, and it has been a great pleasure to me to make the acquaintance of so admirable and zealous an explorer. Knowing something of the country, it is a marvel he is here after his journey in the depth of winter from the neighbourhood of the Karakoram pass, that death-bed of thousands of men and baggage animals; a place the name of which I never see without thinking of Dr. Stoliczka, a member of Forsyth's mission, and a friend of my own, who succumbed to the cold and height of the pass on the return journey from Yarkand.

In connection with Mansarowar lake and its outlet, on which so much has been said and written, I would refer to the pioneer work done long ago by two brothers, Henry and Richard Strachey, who were among the first to make surveys in this part of the Himalaya; Henry beginning in 1846 to 1848.† I would point out how very accurate their work has proved to be, for it must not be forgotten that they had no peaks in Ladak fixed by triangulation to guide them. I am glad to tell you that this talented officer, Colonel Henry Strachey, is still living; he is ninety-three this month. Unfortunately, his sight is quite gone, but his memory is wonderful, and he still enjoys talking of his explorations in Tibet, and that of other workers in the same field.

Dr. Sven Hedin has referred to what I have written on the 'Mountain Systems of the Himalaya,'‡ more particularly with reference to the "Trans-Himalayan Range," a term first used, I think, by Colonel Cunningham (1854), but he included in it the Zaskar axis. Several writers since have used the term in a very general way, more or less hypothetically, according to the period they wrote, and their knowledge of the country, few having personal knowledge of it. Assuming that the basis of any system of orography should be geological structure, when compiling and setting out the sections of the western Himalaya from south to north across the strike of the rocks, I drew largely on the writings and work of Medlicott, Blanford, Stoliczka, and Lydekker, and what I had noted and mapped myself, over a large extent of the northern frontier of India. As a whole, the mountain mass consists of many more or less parallel lines of gneissic rocks and gneissic intrusions, with intervening synclinal basins of stratified rocks, more or less altered. There is great continuity and similarity of structure on certain zones, occupying the same relative positions on sections across the mass; the same physical feature presents itself over and over again, showing that the forces playing a part in the elevation and crushing have been on a wide and gigantic scale. The north-west-south-east Ladak axis represented by the central gneiss of Stoliczka, is a characteristic feature in Ladak for 300 miles, the Indus flowing on its south side, the synclinal trough of

* "Notes on," Journal of the Royal Geographical Society, 1866.

† 'Physical Geography of Western Tibet.' With Map. *Proc R.G.S.*, November, 1853.

‡ *Proc. R.G.S.*, February, 1884.

Nummulitic age holding that position, and resting on it. I took this as a starting line, and the most southern of my Trans-Himalaya lines of elevation, including in it the Mustagh with its subsidiary ranges, the Shayok on the south, and the Karakoram on the north. South-east of Leh for 100 miles, the same gneissic ridge, the Ladak, bounds the Indus on the south, that river having cut through it, and it holds that position for quite 150 miles. The Mustagh axis, I consider, has its easterly extension to the Marse-mik La and the high mass of gneiss north of the Pangkong lake, crossing that to the high range south of the Rudokh plain, where I say, in 1883, "we enter unsurveyed ground"; whether it is continuous to the Aling Kangri (Gangri), of the Royal Geographical Society map of Tibet, is to be seen. Here, these lines laid down by me as Trans-Himalaya are hypothetical; all deductions, made without personal observation of the country, partake of that nature. In the map and sections of 1884, the Ladak range, and all I grouped with it at that time as Trans-Himalaya, I took great care to lay down in dotted lines eastward of lat. 32° and lat. 80°.

Where there is so much of intense interest, it is most difficult in a few minutes to know what to refer to; but among the many discoveries of Dr. Sven Hedin, the history and extent of the lake basins he has visited is one, and I look forward to reading his more detailed account of the country and what he has to say about them. There is an enormous field of observation in Tibet, and his suggestion of mapping the self-contained lake basins is one, showing their extent and former outlets. I only know those of the Pangkong lake and Tsomorhiri, with the extinct lake basins in Rupshu. In the case of Tsomorhiri, local alteration of level has been assigned for the damming of the exit, but ordinary silting up by wind action may have done this. The Pangkong lake, when at the period of the greatest level of its waters, and when fresh, must have extended very far to the eastward—how far would be a very interesting point to solve. No levelling has ever been carried out in either case to determine the height of the old lake deposits. I cannot follow Mr. Huntington that this lake was scooped out by a glacier; my own observations tended to show the dam was formed by talus accumulations from the mountains on the south side. This view is confirmed by Frederick Drew in his description of the lake,* yet I note that Mr. Huntington's glacial lake theory is considered applicable with respect to Pangkong.† The Pangkong has all the appearance of a river valley of ordinary depth eroded in the usual way, once filled up with water to the height of its dam, but which, since that step was reached, has been broken up into a series of lakes by the sedimentary deposits of its largest tributaries as at Ote. All the broad gravelly valleys so typical of this Pangkong country are silted up, having had, I imagine (when the climate was milder and moister), a section of the usual V form.

Sir Henry Trotter: So many references have been made by Dr. Sven Hedin to the exploration work of the Pundit Nain Singh, that I feel bound to say a few words on the subject—in which I take special interest, as I started him from Ladak on his great journey *viâ* Tengri Nor to Lhasa in 1874, in which he discovered and roughly mapped the great lake system of Central Tibet, and on his return to India I took his report and prepared his map.

It is extremely gratifying to find that both Dr. Sven Hedin and Major Ryder have expressed their admiration for the general accuracy and excellence of his work along his actual lines of route—*i.e.* north, east, and south of the great *terra incognita*—the topography of which has been so lucidly described to us this afternoon.

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* 'Tummoo and Kashmir Territories,' p. 323.

† 'Geog. and Geol. of Himalayan Mountains and Tibet' (Colonel Burrard and H. H. Heyden), pt. iii. p. 263.

Dr. Sven Hedin has stated in his paper that the information gathered by the Pundits from native reports is almost worthless. From my own experience I know that for scientific geography hearsay information, whether collected by Pundits or any one else, is of little value. At the same time I was much struck by one statement made by the lecturer, referring to the lake of Teri-nam-tso, marked in dotted lines on Nain Singh's map, that he found its position "almost correct, although the Pundit had never seen it, but had only heard of it."

I must, however, take exception to the lecturer's statement that the result of the Pundit's different journeys can hardly be used for scientific purposes.

Their astronomical determination of latitude are admittedly excellent, and may be accepted as within one minute of the truth; and as regards the much more difficult question of longitude, I will cite two cases. As the result of the protraction and adjustment of Pundit KS's work, in 1874, in the preparation of the map of Eastern Turkestan, I shifted to the eastward by 23 miles the hitherto accepted longitude of Khotan (*i.e.* from 79° 26′ to 79° 59′), and I find that in the latest map of Khotan prepared by Dr. Stein, it is placed in longitude 80° 1½′, *i.e.* differing by 2½ miles only from my original determination.

Again, in preparing Nain Singh's map in 1875, I fixed the position of Lhasa, from his work, at 91° 5′ 30″ E. long., considerably to the east of former estimates. This also held its ground until the recent trigonometrically determined value of Major Ryder's Lhasa, 91° 10′ 46″, showing a difference of about 5 miles, by no means a large discrepancy. I therefore maintain that the Pundit's work has been distinctly of value for scientific geography, although it must, of course, give way to connection by triangulation with our Indian system.*

Nain Singh was a Gold Medallist of this Society, and has been dead for many years, but I consider myself bound to vindicate his reputation for accurate and valuable work. It is due not only to his memory, but also to that of my former chief, the late Colonel Montgomerie, who instructed the first pundits and superintended their work.

To revert to Dr. Hedin's explorations. Nain Singh, in his passage through the lake district, fixed the position of numerous snowy peaks to the south of his route for a distance of several hundred miles; many of these correspond well with Sven Hedin's work. The most important of these peaks, Targot-Yap, the pundit estimated to be 25,000 feet in height, and it is undoubtedly identical with the Targ Gangri of Sven Hedin. Major Ryder, on the other hand, in his recent journey up the Brahmaputra, fixed the position of several snowy peaks to the north of his route, varying in height from 20,000 up to 23,150 feet; but between these two mountain ranges on the north and south, Dr. Hedin has found several other ranges whose existence was unknown. He has crossed seven times this *terra incognita* extending 500 miles in length, and of great and varying breadth, and his work will remain a splendid record of his zeal and energy, and will probably not be improved upon until our grandchildren or great-grandchildren, in future ages, shall explore and map the eight minor blanks which will have been left by Dr. Hedin between his seven lines of route.

To this newly discovered mountain system, Dr. Hedin has most appropriately given the name Trans-Himalaya, to which only one objection can be raised. The mapping of Central Asia has been chiefly done by Russians from the north, English from the south, and by the renowned Swedish explorer from many directions.

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* It is interesting to note that in d'Anville's map of date 1733, the longitude of Lhasa is within a mile of Major Ryder's determination, while its latitude is in error by no less than 22½ miles.

Indian map-makers would naturally call the newly discovered system Trans-Himalaya, but to the Russians it would be Cis-Himalaya. As, however, in a precisely similar case, the Russians have called the range south of the Alai, the Trans-Alai, and we have accepted that name, so we may hope that the Russian geographers will accept the term "Trans-Himalaya," although if *they* had discovered this mountain system, it would naturally have been called Cis-Himalaya.

A few words as to the source of the Brahmaputra. It must always be recollected that a river has several sources, and although both Nain Singh and Major Ryder ascended the great river for several hundreds of miles, up to *one* of its sources, in the Maryum La, yet neither one nor the other has laid claim to have visited its principal source; both of them indicated a much larger stream coming from the north-west; and about 30 miles short of the Maryum La, Nain Singh speaks of the gigantic range visible to the south, the large glaciers of which filled every ravine of that range, and evidently formed the source of the river. It is this glacier region that Sven Hedin has now visited and mapped—a great triumph on which we must heartily congratulate him, as no one can doubt that the area in question contains the principal sources of the mighty river.

The still more complicated and difficult problem as to the sources of the Indus and the Sutlej I must leave to persons having greater knowledge of the subject than myself.

Sir Martin Conway: The fact that behind the main range of the Himalayas there exists another great range, has long been understood by mountaineers, but between the recognition of such a fact and any kind of precise knowledge of the nature of the range in question there is a great gap, and it is this gap which Dr. Hedin's discoveries have done so much to fill. It is hardly necessary to say that no study-drawn outline of imagined mountains ever approximates to the actual facts of mountain-contour which an explorer reveals. This is true even in the case of small details—the ridges and abutments of a single peak, even when the form of its summit has been known, as in the case of K_2. To discuss, therefore, the relative inaccuracies in this or the other sketched-in approximation to what different geographers have believed might more or less vaguely represent the actual form of an unexplored range is to waste time. The man who actually traversed previously untraversed ground, is the first to replace deductions and hypotheses by actual knowledge, and thenceforward his information becomes the starting-point for all future developments in knowledge.

Dr. Hedin has briefly indicated in his papers the central fact, which is to be revealed by the cumulation of all the explorations of Tibet, and the ultimate revelation of the detailed form of that great elevated region. It is the answer to the question, How was that region sculptured out into its present complicated form? Assuming the whole Tibetan area and the adjacent highland to east and west to have been elevated together, with the Himalayas for the southern, and the Kuenluns for the northern scarps, it seems likely that originally the general aspect of the whole region was such as is now characteristic of the central portion, north of the Trans-Himalaya. We may think of it as high undulating ground with ridges running roughly east and west, ridges which in time have weathered to their present condition. The strike of these ridges would naturally tend to shed off the water that fell on the region to east and west along the furrows. As the rain mainly came from the hot south, the southern streams would have been most active, and of the tributaries those draining southward facing slopes would have been the more vigorous. It is for this reason that so many of the principal east-and-west ridges are cut through by what were at first merely short torrents tearing down the slopes. It is, therefore, not at all surprising that Dr. Hedin should have revealed such a

complication in the northern feeders of the upper Brahmaputra, or that he should have found them penetrating through what were originally parallel and continuous ridges. Just as the Indus, the Sutlej, and the Brahmaputra itself cut through the main Himalaya range, having been captured by the more vigorous southward-flowing torrents of the plateau's original edge, so their upper reaches in their turn have cut back into the ranges behind, and doubtless are still cutting back and tending ultimately to gouge out and abolish the last fragments of the great plateaus, with their relatively few remaining salt lakes and wide expanses. Not until the whole detailed topography of interior Tibet is revealed shall we be able to form any complete account of the history of the growth of the great rivers and the various transformations their course has undergone. It is Dr. Hedin's great service to geographical science to have contributed materially to the reduction to relatively small compass of the unknown area which not long ago was so large.

Mr. Douglas Freshfield: Dr. Sven Hedin will, I am sure, understand, if, under the pressure of time, I omit all compliments and congratulations on his wonderfully successful explorations of unknown Tibet.

There are two points, one in what he has said to-day, one in his first lecture, to which I should like shortly to return. I have never myself crossed the frontier of Tibet proper, but from a height of over 20,000 feet in the Debatable land I have looked over many hundred square miles of that country. It is not, I must confess, a region the natural features of which attract a mountaineer; for a proper mountain ought to have a bottom as well as a top. The Tibetan ranges, springing from a platform, as Dr. Sven Hedin has told us, of 12,000 feet, have no bottoms. Let the believers in the spadework done by glaciers explain it as best they can. The Tibetan glaciers have not succeeded in digging valleys. That feat has been reserved for the torrents of the southern slope. In upper Sikhim as you approach the watershed you can recognize the exact spot where the protection of the ice has ceased. This, however, is only an incidental remark; the subject is rather one for my friend and companion, Prof. Garwood, than for myself.

The point in Dr. Sven Hedin's recent lecture on which I wish to express some doubt, is his allusion to military geography. If I have not been into Tibet, I have at least made a study on the spot of some of the routes frem Tibet into India.* Dr. Sven Hedin speaks of the eastern Himalaya as a granite wall impregnable to modern armies and sufficient to protect India from any fear of invasion. He thinks that any apprehensions on this score may fairly be called "exaggerated." At the present time this is in no sense a question of current politics, and I can refer to it without any fear of trespassing on forbidden ground. As a general proposition, I dissent from Dr. Sven Hedin's view; I do not think it is borne out by history. Mountain chains have never served—except in poetry—as efficient ramparts. In this particular case the evidence is at hand. The Chinese have never found any difficulty in sending troops to Lhasa. Of course they send them by the regular road, and not over the remote highlands Dr. Sven Hedin has been the first to reveal to the Western world. They have done more. As Dr. Sven Hedin has reminded us, at the close of the eighteenth century they sent an army of 70,000 men into Nepal and won a battle within a few miles of Katmandu. It is true that a modern army carries more impedimenta than a primitive force, but on the other hand the facilities for light transport and provisionment have increased. The Chinese may at any day imitate the Japanese in adopting and improving on European methods. In 1888 a Tibetan force crossed the Himalaya, threatened Sikhim, and alarmed Darjiling. We have

* See *Geogr. Journ.*, January, 1904; and *Journal of the Society of Arts*, February, 1905.

recently sent an army with light artillery over the outer Himalaya to Lhasa. No doubt in the Himalayas, as in the Alps, it is not so much the actual passes as the gorges on the south side of the chain that form the most formidable obstacles to the invader. But most gorges have a way round them, and there are too many to guard them all.

I do not anticipate that India will be invaded from the north-east in the lifetime of any of those here present. But I believe that if China were allied with a Western power and a Chinese force were collected in the Brahmaputra valley, it would necessitate the detention of a corresponding force to protect Bengal, and thus interfere with the adequate protection of the North-West frontier. I cannot but regret, therefore, that Tibet has been handed over to China, body and soul, in place of being constituted in some sense a buffer state. Dr. Sven Hedin suggests that the situation produced by an attempt to invade India on this side would be "amusing." It might be so to the disinterested observer at a distance, but I doubt if this would be the point of view of the officials at Calcutta responsible for the defence of the British possessions in India. Dr. Sven Hedin is so great an authority on all things Tibetan that I fear that his words—even in an *obiter dictum* —may be taken in a sense and given a weight which he possibly does not intend by some civilian and economical statesman. I have, therefore, ventured very briefly to suggest a view which is, I know, held by others far better qualified than myself to enforce it.

Captain Rawling: I understand that the discussion of Dr. Sven Hedin's last journey which is taking place to-day will be confined to Southern Tibet, and will mainly fall under four heads—the mountainous region lying to the north of the Brahmaputra, the sources of the Brahmaputra, and the sources of the Sutlej and the Indus, and to that part of Tibet alone will I confine my remarks. I do not intend to argue on the pros and cons of the discoveries of former travellers, but simply to lay before you the more valuable geographical features as seen during our journey in 1904-5, in order that they may be compared with the latest information obtained by Dr. Sven Hedin.

It must be remembered that my expedition then was a political mission and not a geographical one. We were compelled to travel at express speed and to cover 1100 miles, the distance from Gyangtse to Gartok and Simla, in three months. Nevertheless, much fresh geographical information was obtained and 40,000 square miles of country surveyed. This work would have been impossible had there not been attached to my expedition a survey party under, and I say this without the slightest intention of flattery, two of the finest experts in survey work to be found in any country, Major Ryder and his assistant, Captain Wood.

The remarks I intend to make are based on the unanimous opinion of all of us, formed when we were on the ground, and from the closest observation that the limited time at our disposal would permit of. Of the perfect accuracy of Ryder's work, Dr. Sven Hedin bears generous witness. It does not profess to be a complete map of the entire basin of the upper Brahmaputra, but simply the country which could, with extreme labour and only by skilled hands, be accurately surveyed during a hard and rapid journey. A glance at Ryder's map will show that the Chata Tsangpo, opposite Saka Dzong, and some other tributaries, are entered in dotted lines, showing where the courses of the rivers appeared to lie, judged by the trend of the mountains as seen from a great distance.

Having mentioned Saka Dzong, let me break off for one moment, to pay a token of respect to the memory of that faithful servant of Sven Hedin who died here. Mahomed Isa was one of the finest characters it has been my fortune to be thrown with. Trustworthy and indomitable in his work, his knowledge of Asia was unequalled by any native, for he had accompanied Younghusband in his famous

journey from China, he was with Cary, with Dalgleish who was afterwards murdered, and with Dutreuil de Rhins, where he was a helpless witness of his master's violent death at the hands of the Tibetans. He acted as my caravan bashi in the Gartok expedition, accompanied Sven Hedin during his recent journey, and died, after thirty years of faithful service, at this desolate spot.

The early reports which reached England respecting Dr. Sven Hedin's discoveries gave the impression that a great range, rivalling the great Himalayan chain, had been found far to the north of anything seen by us. As Dr. Sven Hedin has since informed us, the report was incorrect, no such range being in existence, and he has also proved that the range surveyed by Ryder, which runs parallel to, and distant 50 miles from, the north bank of the Brahmaputra, is not surpassed in altitude by any range of mountains right up to the Kwen Luen. But of equal importance to this negative proof are his discoveries of numerous self-contained basins formed by, not one, but many ranges, some of which constitute and define exactly the entire watershed of the upper Brahmaputra basin, and extend its limits far beyond what was formerly believed to be its area.

You will notice the similarity of the drainage system of the northern slopes of the Himalayas and what I will call at the present moment Ryder's mountains. The rivers on the northern slopes of both at first flow northwards, then, when stopped by another and lesser range, turn to the south, and, cutting their ways by devious gorges through their original ranges, join the waters of the southern slopes, and form a part of the great rivers which finally pour into the Indian ocean. Now, it is an established fact that the rise of the great Himalayan range has taken place during recent geological periods, and, as Colonel Burrard says: "The whole length of the great Himalayan range belongs to one geological age, and in the same geological age as the mountains of Afghanistan and Beluchistan, in fact the ranges of Central Asia appear to belong to one great system, and to have no separate existence from that system." But it has remained for Dr. Sven Hedin to prove that all these ranges are alike, and that the earth movements taking place in one are duplicated in the other. Alike in their formation, the final results are opposite: the basin of the Ganges cannot increase in area, but the basin of the Brahmaputra can and will, for as the tributaries, in the course of centuries, cut back into the plateau by head erosion, so will the self-contained basins to the north be absorbed and finally form part of the great Brahmaputra basin, provided there is no material decrease in the rainfall.

And now as to the name of the mountainous system. Personally, I do not like the term Trans-Himalaya, for by rights this belongs to the range lying immediately to the north of the Himalayas, and between that range and the Brahmaputra. Foreign names and duplication of names are, if possible, to be avoided. May I suggest such a one as *Peu Kangri*, or the Snow mountains of Tibet, or *Peu Lho Kangri*, a free translation of the Snow mountains of Southern Tibet. Kailas range, the name suggested by Colonel Burrard, is good for that particular range in which Kailas is situated, but, as Dr. Sven Hedin has demonstrated, this is only one of similar ranges, and therefore it hardly seems quite appropriate for the whole system.

I will now leave this district and move to the source of the river. Dr. Sven Hedin takes a too literal reading of certain remarks of Ryder and myself with regard to the Maryum La being the source of the Brahmaputra. Where the matter is dealt with in a more detailed and scientific manner it is evident that we clearly recognized the main source of the river: for, as Ryder says, when facing the Maryum La: "We could see the watershed range ahead of us, from the valleys of which innumerable streams issue to form the Tsangpo, the largest coming from the snowy

range to the south-west." Again, Ryder, in his map—and this after all is the best proof—distinctly shows the source in the glaciers far to the south-west of the Maryum La. It seems to me that the whole question can be summed up in the sentence: that the principal sources of the Brahmaputra were known to lie in the Indo-Tibet borderline glaciers to the south of Gurlchu Tso, but it has remained for Dr. Sven Hedin to survey and locate more definitely than has ever been done before, the headwaters of the river.

Next comes the question as to the sources of the Sutlej. First of all, what is a source? I maintain, though it is possible I am in error, that it is the longest visible branch of a river system, and, if there are two branches of equal length, then that which carries the most water at its greatest flood. On this hypothesis I base the following problem and its solution. To start at the beginning, it will be granted that small rivers run into Manasarowar and that that lake and Rakas Tal are connected, for by photographs and the testimony of every traveller, except, of course, Mr. Savage Landor, such is proved to be the case. All that remains now is to determine whether the Sutlej is connected with Rakas Tal. At present there is no surface outflow, and none has been reported for many years. From my definition of a source, therefore, I am forced to draw the conclusion that the connection does not exist. Dr. Sven Hedin takes a contrary opinion, basing his view on the probable supposition (also held by Henry Strachey in 1846) that some of the water of Rakas Tal filters through the soil, afterwards rising as springs in one of the tributaries of the Sutlej. In 1905 Mr. Sherring reported that the natives likewise believe in this underground escape. But it is an extremely difficult thing to prove. Even the fact that Rakas Tal is fresh at the present time means nothing, for we know that the lake did regularly overflow forty or fifty years ago, and it would take centuries for a lake the size of Rakas Tal to become salt. Ryder, I consider, is correct in placing the present source in a branch flowing from the southern hills. I may be quite wrong in my reasoning, but the whole question appears to turn on the definition of the word "source."

I am to-night making observations based purely on personal experience, and as I have never visited the northern and main branch of the Indus, will not venture an opinion as to its source.

In spite of the interest centring around the sources of the Brahmaputra, Sutlej, and Indus, yet, as a matter of geographical value, they sink into comparative insignificance when compared with the definite elucidation of the northern watershed of the upper Brahmaputra basin, and the intricate system of ranges found in and beyond that region. And for this knowledge we are entirely indebted to Dr. Sven Hedin.

Dr. T. G. Longstaff: I beg to congratulate Dr. Sven Hedin on the successful conclusion of his latest journey, a journey during which he had again displayed those qualities of endurance and determination with which we have always associated his name. May I particularly congratulate him on being the first traveller to force his way right across the centre of that great range of mountains which lies to the north of the Indus-Brahmaputra trough.

I have a few comments to make on this paper, but I feel that they are privileged for this is a scientific society, and the academic discussion of papers must always be one of its chief functions. I wish to draw attention to that range of snow mountains discovered by Nain Singh in 1874, and along the northern side of which he travelled for more than 800 miles ('Walker's General Report,' G.T.S., 1874–75, p. 20). I am uncertain whether Dr. Sven Hedin includes this in his own Trans-Himalaya. The lecturer identifies Nain Singh's Targot Lha with his own Targo-gangri, and I think that when he has worked out his observations we shall find that his own Shakangsham

is none other than Nain Singh's Shyalchikang Jang. I was sorry to hear that remark deprecating the value for scientific purposes of the work of such very remarkable men as the late Nain Singh, C.I.E., and Kishen Singh, B.B. Many of us must recall the very different opinion of them which was expressed before us by such authorities as Sir Frank Younghusband and Major Ryder less than four years ago. I may be excused for recalling this testimony, since I am personally indebted to Kishen Singh. The methods of any traveller may be considered antiquated by those who follow in thirty or forty years' time. It is almost a truism to say that no explorer can expect to produce an original map in which corrections will not be made by those who come after him.

It is rather surprising that the lecturer is so unappreciative of Trelawney Saunders. His delineation of Dr. Sven Hedin's 'Trans-Himalaya' in the 'Atlas of India' (Stanford, 1889; 12 Maps and Memoir) is based on the work of the Pandits, including Kishen Singh's later journeys, and I still venture to recommend it to the notice of any one interested in this discussion. Saunders calls it the Gangri range, because it is *par excellence the* snowy range of Tibet; although, as was pointed out in 1877, and again in 1896, Brian Hodgson had already adopted the name "Nyenchenthangla." ('Selections from the Records of the Government of Bengal,' Calcutta, 1857, p. 88, etc.) In the Memoir, Saunders begins his description as follows: "The northern side of the great Tibetan trough culminates in a range that, for extent, importance, and altitude, may well stand alongside of the parallel ranges of the Himalaya."

This range is included in that great mountain-system described by Burrard and Hayden in their 'Sketch of Geography, etc., of the Himalaya and Tibet,' as the Kailas range. It is definitely known to extend for more than 1400 miles. Their frontispiece shows its middle section of about 600 miles extending eastward as a continuous range from the 80th meridian until it is joined by the Ninchinthangla at about the 88th meridian. In this middle section they give a list of a dozen peaks ranging from 20,000 to upwards of 23,000 feet. These, with numerous lesser points, were fixed (mostly by Captain Wood) by trigonometrical methods of the first degree of accuracy, in the course of the expedition to Gartok under Captain Rawling's leadership. The series may be considered an extension of the G.T.S. of India. Certainly its parentage is irreproachable.

I am quite sure that the lecturer did not realize what he was showing us in that Chart XVII. of Colonel Burrard's, and upon the blanks in which he laid so much stress. That diagram is entitled 'Chart to illustrate how the great Himalaya range terminates firstly at the Indus, secondly at the Brahmaputra.' To render that chart clearer, such insignificant details as the Sutlej river, together with *all* the mountain ranges both north and south of the great Himalaya, except those at its two extreme ends, are purposely omitted; therefore, naturally, the Kailas range is omitted with the others. But in any case, as I understand him, Dr. Sven Hedin excludes this great range from his own Trans-Himalaya, because Wood's peaks are not situated on the actual water-parting. Yet how could we describe, and by what name should we call, the loftiest peaks in the world if we applied a similar line of argument to the Himalaya itself?

As to nomenclature, we already have Ninchinthangla, Gangri, and Kailas. The latter name was first applied to the whole range by Cunningham in 1847. You will find the name Kentaisse (a misprint for Kenlaise, the old form of Kailas) on Rennell's map of 1782, but he gave it to that well-known peak only. Now "Trans-Himalaya" is suggested to us. As the lecturer has himself admitted, Cunningham has already bestowed the name Trans-Himalaya on that range which in Ladak and Western Tibet separates the valley of the Sutlej from that of the Indus ('Ladak,' p. 43 and

plate 1). Morphologically, this range is continued eastward north of the true Himalaya, though it is broken through by the Sutlej. It culminates south of Mansarowar in Gurla Mandhata (25,350 feet), the highest mountain situated entirely within Tibet. It extends eastward again right up to the bend of the Brahmaputra, carrying twenty-five measured peaks of over 20,000 feet. It is quite a distinct range from the Great Himalaya. Standing on Gurla Mandhata, the Himalaya of Nepal seem almost as far to the south as the Kailas range seems to the north, so that the beholder realizes that he is already standing on a truly trans-Himalayan range, and if any range is to be called Trans-Himalaya, it should be this, as Cunningham perceived. But Himalayan nomenclature is already too complicated. We have Upper, Lower, Outer, Inner, Mid, Sub, Lesser, Great, Central, and Trans-Himalaya. It was to obviate any further extension of the name that Burrard and Hayden labelled the whole of this range (I mean the first range north of the Great Himalaya) the Ladak range, and applied the name Kailas range to that system still further to the north and across the Indus-Brahmaputra trough. The analogies of Trans-Caucasia and Trans-Caspia do not, I think, hold good. Such terms are very convenient to apply to a region whose exact limits you do not wish to define, but they are not sufficiently distinctive to apply to a mountain system. For many years we have read of the "trans-Himalayan regions" and of the "trans-Himalayan sources" of Indian rivers. Let us also speak generally of trans-Himalayan ranges; but we must give up this useful adjective if the name is to be affixed to one particular mountain system.

Discussion as to the exact location of the source of any great river system is complicated by the absence of any universally accepted definition as to what actually constitutes the ultimate source of a river. Since it has already been mentioned this evening, I will begin with the Brahmaputra.

In 1864 Mr. T. W. Webber, Colonel Edmund Smyth, Henry Hodgson, and the Hon. Robert Drummond (who in 1855 launched his collapsable boat on Mansarowar lake) were at Taklakar, in Purang. Thence they crossed the lofty Dak Eo pass to the south of Gurla Mandhata, a route seldom traversed even by natives. This led them over into the very head of the Brahmaputra valley. That river is described as taking origin in the glaciers or a great peak called Limi. Of course this is a Bhotia and not a Tibetan name. They followed down the main stream to within sight of Truksum, 80 to 90 miles from the source, and only 50 miles above Tradom. This expedition is described by Mr. Webber in his 'Forests of Upper India' (chap. xi.), and I think he and his companions must be given the credit of being the first travellers to reach the source of the Brahmaputra. At the same time it is obvious that Dr. Sven Hedin is the first to give us a detailed survey made on the spot, although he substantially confirms Nain Singh's general accuracy.

The whole question of the hydrography of the Mansarowar basin is, I know, a very complicated one, for, as the lecturer evidently perceives, we are watching a change in the "Pulse of Asia," but I would venture to urge that the chief credit for its solution must always remain with Henry Strachey. Burrard and Hayden, after reviewing and summing up all the evidence, definitely include it within the Sutlej drainage area, a conclusion with which Dr. Sven Hedin seems in entire agreement. The hypothesis of an underground communication between the two lakes was advanced by Colebrooke in 1816 ('Asiatic Researches,' vol. **12**, p. 376), in consequence of Moorcroft's failure to find a visible efflux. I think any one who examines Sherring's panoramic photograph ('Western Tibet,' p. 271), which shows the whole channel between the two lakes, will see where that underground communication is situated. The reason Moorcroft did not find this channel is quite simple. In his anxiety to miss nothing, and he rarely did miss anything, he

walked along the actual lake side of Mansarowar, and the shingle bank over the effluent channel, beside which he was walking, effectually concealed that channel from his view.

The source of the Sutlej was formerly that stream which enters the Gunchu Tso on the west side of the Maryum-la. It is interesting to recall that Alexander Gerard placed it there ninety years ago ('Account of Koonawur,' etc., p. 139). This lake formerly discharged into the Tokchen river, and so reached Mansarowar. Now the first link in the chain is broken. The Gunchu Tso, shrunken and salt, is no longer able to find an exit towards the west. So we regarded the Tokchen river, with a course of about 30 miles, as the prime source. Now Dr. Sven Hedin finds that the Tagi-tsangpo carries a greater volume of water down to Mansarowar, and so makes this stream the genetic source of the Sutlej. But, as he himself perceives, another link in the chain is giving way between Rakas Tal and Tirthapuri, and when this process is complete, and the Mansarowar basin is quite cut off from the Sutlej, another source will have to be found. Perhaps this may come sooner than we expect. In August, 1905, I forded the Sutlej a mile above Tirthapuri, and about 6 miles above the point where the Chukar joins the main river. During the same month I crossed the Darma Yangti and the Guni Yangti at a point distant about 23 miles from the Sutlej. These two streams unite with the Chu Naku and the waters from the Gyanema lagoons to form the Chu Kar, which discharges into the Sutlej. Now I found as much water in both the Darma and the Guni Yangti as I found in the Sutlej at the point named, though they are not so wide as the latter river. The united volume of the Chu Kar itself must therefore be very considerable. Indeed, if we accept Dr. Sven Hedin's own definition, we cannot even now locate with certainty the genetic source of the Sutlej. Let us suppose some future traveller proves that the Chu Kar itself carries more water than the head-stream of the Sutlej after it has been joined by the Missar river. He may then seek the source of the Dharma Yangti amongst the Nui peaks to the south. Should he return and tell this or some other Society that he has discovered the true source of the Sutlej, some one would, I trust, make the comment that, in 1846, Henry Strachey said, "It is a question that can be decided only by actual measurement perhaps, whether the main source of the Sutlej be not in the Darma Yankti" (*Journal Asiatic Society of Bengal*, 1848, p. 157).

In reference to the Indus, the lecturer has told us how Nain Singh crossed it at Giachuruff, some five marches below its source. But we must not forget that at Giachuruff, in spite of the imminent danger of his position, this intrepid surveyor voluntarily separated himself from his companion, despatching the latter up stream in search of the river's source (*Proc. R.G.S.*, vol. **39**, p. 151, etc.). This second pandit made his way up the river for nearly 50 miles, and was only stopped at Jiachan by the unwelcome attentions of a party of robbers. These may have been the fathers of some of those friends of Dr. Sven Hedin's about whom he told us the other night. At any rate, these robbers did him a good turn, for they prevented the pandit from reaching the Lion's Mouth itself, and in consequence, Dr. Sven Hedin has gained the distinction of being the first traveller to reach the ultimate source of the Indus.

May I add in conclusion, though it must be obvious to all of us, that Dr. Sven Hedin has only been able to place before us to-night a very small portion of his vast store of observations, and that until these come to be published in full it is almost impossible to realize the great importance and the very solid scientific results achieved in the course of his latest expedition.

Major Lenox-Conyngham : First, looking at the name as a whole, there are two grounds of objection :

In the first place, the name, as Dr. Sven Hedin has mentioned, has been used before. It was applied in 1847 by Sir Alexander Cunningham, to a range which lies to the south of Ladak. It is no longer in use, but to resuscitate an old name and apply it to a new locality is to sow a seed of future confusion.

In the second place, a great many names of the same sort as Trans-Himalaya have been used in the past, there have been Upper-Himalaya, Lesser-Himalaya, Outer-Himalaya, Lower-Himalaya, Sub-Himalaya, Inner-Himalaya, Great-Himalaya, Central-Himalaya. To add yet another to this confusing series is a course which is much to be deprecated.

Next, considering the use of the prefix "trans."

Unless used with the sense of motion, as in Trans-Atlantic steamer, this prefix should always be in contradistinction to "cis," and even though the word with the prefix "cis" may not be in general use, there should be something which could be called by that name. There should be a distinct line of demarcation separating the cis-side from the trans-side. Thus, in the case of Trans-Caspia, the Caspian sea is the dividing-line, and we have a Cis-Caspian region corresponding to Trans-Caspia. So with the Caucasus, there is a Cis-Caucasian region balancing Trans-Caucasia. But in the case of the proposed Trans-Himalaya there is no Cis-Himalaya, but the plains of India, which could not appropriately be called by that name, and which forms no adequate "pendant" to the highlands of Tibet.

Again, in the case under discussion, the Himalayas do not form the line of demarcation, the Indus-Brahmaputra valley is the dividing-line between the Himalayas and Dr. Sven Hedin's Trans-Himalayan system, so that Trans-Tsangpo, or some such name, would be more suitable if the prefix "trans" is to be used at all. It is true that the case of the Alai and Trans-Alai ranges affords a precedent, but it is an unfortunate piece of nomenclature, and is rather an error to be avoided than an example to be followed. It was quite correct to speak, as Montgomerie and others did, of Trans-Himalayan exploration, for then the Himalayas formed the dividing-line, and everything on the other side of them was included in the term.

But the most serious objection to the name Trans-Himalaya does not lie in the prefix "trans," but in the word Himalaya. The important, the primary, geographical feature of this part of Asia is the great Tibetan table-land. This is the dominant fact. The Himalayas are merely the southern rampart of this mighty mass—an incident of its configuration. To take the name Himalaya and apply it to the parent mass is to call the greater after the less, the cause after the effect. This is a course which should at all costs be avoided. Moreover, the term Himalayan already covers a very wide area, and from a practical point of view it is undesirable to extend its use. When Colonel Burrard was writing his 'Sketch of Himalayan Geography,' he decided, in agreement with Sir T. H. Holland and others, that the name Himalaya should be strictly confined to the southern rampart of the Tibetan mass, and that the number of compounds, such as sub-Himalayan, should be cut down as much as possible. These authorities view with dismay the suggestion to bring yet another of such compounds into use, and to carry the name Himalaya further into Tibet.

In a recent letter, Colonel Burrard says—

"I trust that Dr. Sven Hedin will not think that the objections raised to the name trans-Himalaya are frivolous or obstructive. I can assure him that they are considered weighty by men who have devoted their lives to the study of geography and geology, and who wish to avoid all risks of future inconvenience and controversy."

The PRESIDENT (after the discussion): If nobody else wishes to speak, I should like to make one or two general remarks in bringing this interesting discussion to a close. My remarks will be quite general, because I am not an expert in matters of Tibetan geography. I have always been taught to concentrate my mind as far as possible on things and facts, and to consider that words and names are far less important. The misuse of words, of course, may do harm, but words and names in themselves are of comparative little importance. Now, facts may, broadly speaking, be divided into two classes—facts which are known, and facts which are not known. To-night we may add a third class—facts which are known to Dr. Sven Hedin and which are not known to us. I make this remark, because it does seem to me extremely hard that an explorer, after coming back from a great expedition like that which our distinguished guest has undertaken, should be expected immediately to give his results to the world in a full and complete form. It is absolutely impossible for any man, work he ever so hard, to give the full results of his labours until after many, many months' labour. If time had permitted, it would have been interesting if Dr. Sven Hedin could have given us a few more specimens out of his huge storehouse of information; for there are so many important subjects he has yet hardly touched on. There is, as a single example, that great question of the desiccation of Tibet—whether this country is getting drier quickly or slowly, temporarily or permanently. With regard to the known facts concerning the white patch on the map, which Dr. Hedin has covered with his exploration, we all know what was done by Nain Singh on the west and north, by Littledale on the east, by Ryder and Rawling on the south, and concerning the peaks which have been observed by Wood at a distance. These facts are all known, and on record. Those discoverers have had due credit given them; and I am quite certain that Dr. Sven Hedin would be the very last person to wish in any way to detract from what they have done. Then, with regard to the question of what I may call "hypothetical map-making"—the filling up of white unexplored places on slender information—I fully agree with Dr. Sven Hedin that the best thing is that some one should go to these places and ascertain the facts as he has done. This is not always possible, and in these circumstances we must be permitted to fill up these blank spaces as well as we can, a work which is useful if clearly indicated as hypothetical.

I have always been struck with the profound wisdom of the words of Bacon, who said "that the truth comes sooner out of error than out of ignorance." The filling up of a blank space in a map may be erroneous, but it may also be a step in the right direction. I think, if Dr. Hedin will look back, he may possibly recognize that where maps have been filled up even erroneously they have stimulated his imagination and helped him forward in the path of exploration in which he has done such wonders. But the making of these hypothetical maps, this filling in of blank spaces on slender information, is a totally different thing from filling up the map from actual knowledge. The two operations are quite different, and need not be discussed together. One is a hypothesis for the purpose of facilitating discovery, whilst the other is actual work done, for which the same credit is due whether preceded by a correct hypothesis or not. Lastly, with regard to the facts which are indisputable concerning Dr. Sven Hedin's work. If we take two points in Tibet, and if we draw a curved line between them some 300 or 400 miles long, we shall find there is all along that line a complicated system of mountains which Dr. Sven Hedin has called the Trans-Himalaya range. Now, it is a fact that no civilized man ever put his foot on any part of that line of mountains before Dr. Sven Hedin did, and that is a fact that will remain for ever recorded to his honour. With regard to the name of this range, I intend to say but little. He has told us that his

proposal has been approved by the Viceroy. Possibly he will think I am prejudiced when I tell him that my belief is that this question will be settled in a way I have been taught to believe an immense number of questions have been always settled, and that is on the principle of the survival of the fittest. Several objections have been urged against this name, some of which, I think, are of little value. The only objection that strikes me at the moment as of weight is that to which Dr. Sven Hedin has himself alluded, namely, that if you look at this range from the north the name Trans-Himalaya is inappropriate. He also mentioned the name Anti-Himalaya, and I allude to it for two purposes. In the first place, because the title Anti-Himalaya seems to be perfectly correct, and not open to this objection to which I have alluded. I also want to place it on record that if Dr. Sven Hedin should see that name Anti-Himalaya on any map—whether he will do so or not I do not know—I ask him to remember that he with them still occupies the honourable position of godfather to this enormous range of mountains. But I am not here to sit in judgment on a technical matter of this sort, and I do not intend to do so, because I am not an expert, and because I do not think that the question of a name is one of prime importance. In short, in my opinion, on an occasion of this sort, what we ought to do is to concentrate our minds on the deeds of a great explorer, and not on the words by which those deeds are described. Dr. Hedin, without doubt, has done magnificent work, and the deeds he has done in filling up the white spaces in Tibet will stand on record for all time in the book of geographical discovery, greatly to the honour of our distinguished guest.

Dr. Sven Hedin.

I wish to express my very hearty thanks to those gentlemen who have been so kind as to take part in this discussion, and for the very kind things most of them have said of me. Specially was I glad to hear what Sir Clements Markham had to say, as he had taken such a great interest in the development of our knowledge of Tibet. I have already mentioned my own opinion about Sir Thomas Holdich's suggestion to call the range the Bongba system, and so I do not need to enter upon that. We have heard several propositions for the name: the Bongba range, the Trans-Tsangpo, etc., and I think the real name that is to survive, as the President said in such a beautiful way, will have to go through some kind of a struggle for its existence; but I think it will clear itself out of the struggle. Then as to Colonel Godwin Austen's communication, I found it extremely interesting, especially what he said about lakes Panggong and Tsomahiri, because the problem of these two lakes is exactly the same problem as the hydrographical problem of Rakas-tal and Mansarowar, although the problem of Panggong is advanced much further, and I think it is extremely easy to find the valley through which the effluent of Panggong flowed out and became a tributary to the Sheyok river. I measured the beach lines of the Panggong lake at some places, and found the highest of them to be 175 feet over the present level of the lake, so I suppose the height of the threshold in the valley must be something like 175 feet; but I quite agree with Colonel Godwin Austen that the problem cannot be definitely solved, unless a precise level has been carried out in the valley. This is extremely easy to do; any Commissioner of Ladak could do it on a holiday.

Now as to Mansarowar and Rakas-tal, they have not yet advanced so far as Panggong. Panggong is, as we know, salt because it is absolutely cut off from the Indus system. There is no underground connection with the Indus, but in Rakas-tal there is an underground connection, and I cannot agree with Captain Rawling when he says it would require centuries for the lake to become salt. I do not

think it would take centuries. I believe it would take only a few years, as I have seen the lakes situated on the right side of the lower Tarim filled artificially by the natives by opening small channels on the river, and as the ground is lower than the river itself, the depressions become filled when the channels are opened. Sometimes the natives close the connection between the river and the lake, then in three years the water becomes salt, as I have proved myself. They do it because they profess that the taste of the fish becomes much better when the water is salt; and that is only a question of three or four years. Of course, it would take a longer time for Rakas-tal, as it is much deeper; but anyhow it would not take centuries, I am quite sure.

Now as to Sir Henry Trotter. I emphasize what I said about the native explorers and the Pundits. I have said several times how I admire their work, and I admire specially Nain Singh, and nobody has admired him more than I, because nobody has travelled so much in the same country as he as I have both up the Tsangpo and on his journey of 1873–74. I have said that the Pundits' topographical work, especially in any country they have seen with their own eyes, is always correct and always admirable. Their reports, however, are useless for scientific purposes. When I talk about scientific purposes, I do not mean astronomical points, as I know how well those determinations agree with other observations; I mean a description of the physical geography. A pundit can easily pass a very great lake, and never tell you whether it is salt or fresh. He can cross a river, and not tell you whether it is a big or small river. He can cross a mountain without telling you whether it is solid rock or loose material. I mean it is impossible for a geographer to draw any valuable physico-geographical conclusions from a report of a pundit, and what we get from them is the topographical idea of the country. I have also said that their information on any parts of a country which they have not seen with their own eyes, but about which they have collected information from the natives, has proved to be absolutely impossible, and I will show that presently on the map. Sir Henry Trotter will remember, as he worked out the map of Nain Singh of his journey from Leh to Lhasa, that Nain Singh filled up the map south of Dangra-yum-tso, and placed a river he calls Dumphu or Hota-tsangpo, which goes round in the most extraordinary way I have ever seen for a river; it goes round like a semicircle, and that in the part of Tibet which is situated south of the watershed, and in a country where most of the water goes to the Brahmaputra and the Indian ocean. That is what I mean. I admire the Pundits. At one time we had nothing else to do but train the natives, but I agree with Delmar Morgan, who says that they are not trained as we are, and their education is not sufficient for the solving of the problems of modern scientific geography. For instance, it is very difficult to use the information Nain Singh gives us of Tashi-bup-tso in the middle of Tibet, which I passed twice. It would have been extremely important to know from the Pundit the exact length of Tashi-bup-tso. I passed it, but to my eyes it had absolutely disappeared. It was a salt lake, and at the place where Nain Singh puts his big lake of Tashi-bup-tso I did not find anything except shining white salt, and not a drop of water; but, on the other hand, Tong-tso still exists. I mean that it would have been interesting to get some detailed information from the Pundit about Tashi-bup-tso, and as I saw it in 1908, that is to say, some thirty-four years after him, I should have been able to get a really correct figure of the rate at which one of the salt lakes of Tibet has dried up. That is what I mean by scientific physical geography. But, of course, I like the Pundits; and I like Nain Singh just as much as Sir Henry Trotter, if not more.

It was very interesting to hear what Sir Martin Conway had to say; and as to Mr. Freshfield, I think it was a very important remark he had to make. Of course

the Trans-Himalayas begin from a height of 12,000 feet; I do not intend to enter upon that. On the strategical question I really did not mean the Chinese when I was speaking about a "northern enemy," who could put the safety of India into any danger. I did not mean the Chinese at all—I meant somebody else. So when the Emperor Kyang-lung in 1792 sent his 70,000 Mongolians and Chinese through China to Tibet and down on the ordinary way to the neighbourhood of Katmandu, he did not go the way I meant at all, because I meant the roads I knew myself. I meant to say the whole of Tibet is impossible for an army to cross. Mr. Freshfield refers, in a very interesting letter I got from him the other day, to the fact that the expedition to Lhasa proved that field artillery can easily be brought up to Tibet. But I would say that it would be impossible to carry field artillery through Tibet from the north; and it is almost impossible to cross Tibet with an army, even if you have only field artillery. I have crossed Tibet several times, and I have found that 90 per cent. of the caravan is lost *en route*, and if that is the case with a little caravan, it must be still more the case with an army; very often you come to a spring, or some lakes, which prove to be sufficient for your own little caravan, but which would never be sufficient for an army.

Captain Rawling's communication is important, and I know from his book and his publications that we agree very well on most of the points—I believe even as to the Sutlej problem. As to the geological details he mentions, everybody will understand easily, that there is no possibility for me to enter upon such details now. But I do not agree with Captain Rawling when he calls the northernmost range of the Himalayas the Trans-Himalaya; I regard it as belonging to Himalaya, so much the more as it is the water-parting range. Then he proposed that the name Peu Kangri, or the snow mountains of Tibet, or Peu Lho Kangri, the snow mountains of Southern Tibet, should be given to this range. That is all right, but it is quite unnecessary to introduce any Tibetan names into Tibet.

As to Dr. Longstaff, he has brought forward a great many details; I could, if wished, come with many more details about this country, but there is no time now. Those ranges seen to the south by Nain Singh on his journey are by no means the head range of the Trans-Himalaya. That is a mistake. I do not see what Shakangsham has to do within the limits of this discussion at all. Of course everything north of the upper Brahmaputra belongs to the Trans-Himalayan system, but I say from the valley one cannot see anything except those mountains situated close to the route. As a rule those mountains coming down to the upper Brahmaputra valley hide everything that is behind. It is very comfortable and easy to sit down in your study at home and write down a lot of hypotheses; go out and try to observe the facts; it was open to everybody as well as to me. Sir Martin Conway has just pointed out the difference between deductions and hypotheses and actual knowledge. It is very surprising, but anyhow a fact, that one member of the Council of the R.G.S. has maintained that only 100 miles of the Central Trans-Himalaya belong to me, whereas all the rest was known before, and that I had no right to call it a discovery. Those who are not familiar with the exploration of Tibet will very likely be taken in by all the names, dates, longitudes, latitudes, and figures in Dr. Longstaff's remarks, but the experts present in this hall will not agree with him. The whole of his argumentation is built on a foundation of extremely fragile and valueless hypotheses and theories brought forward at different epochs, more specially by Hodgson, Saunders, and Atkinson, and it is not surprising that the whole construction must fall to pieces when brought face to face with the real mapping of the country. I need only remind you of the fact that all three have *one* mighty range in the middle of the Bongba country, and that there are in reality ten absolutely different and sharply defined ranges with broad open

valleys between them. Nevertheless, Dr. Longstaff says that Atkinson's map and my sketch-map are "practically identical." I think it is a great pity that any member of the R.G.S. should ever have published anything of that sort, and it is a bad excuse when Dr. Longstaff now explains that he meant the map that I had published in the *Times* of November 10, as that map was a photograph of the sketch-map on which I have demonstrated my last journey to-night. Major Ryder and Colonel Burrard believe that the peaks seen and measured by Wood and Ryder from the route along the river belonged to *one* range, which was also supposed to be the watershed of the Upper Brahmaputra. That this is Burrard's opinion can directly be seen on one of the maps in his and Hayden's splendid monograph of the Himalayan and Trans-Himalayan mountains, a map representing the drainage area of the upper Brahmaputra. Now those peaks are situated on different ranges, so from whatever point you regard the orography of this part of Tibet, you can never talk of *a range* joining those peaks. There is one reason more why "The Kailas range" has to disappear—it does not exist in reality. But if you are going to speak of the Kailas system, you can do so if you like; I will anyhow take the liberty to call the ranges on both sides of the watershed the Trans-Himalayas. And the signification which is the strongest will be accepted by geographers, and will survive long after the golden inscription on your graves and mine has disappeared.

Well, the situation is this: Dr. Longstaff has never touched the country of which I am speaking now, that is why he has been obliged to quote half a dozen travellers and geographers who have never been in the country either. They have probably collected their information from native explorers who have never been in the country either, and who have thus got their wisdom from natives. Is it surprising, I ask you, that the result of this uncritical criticism is a hopeless confusion? I won't enter upon the question of Mansarowar any more. As Dr. Longstaff mentioned, it is not so much the question whether it is the chief source or not, that is why I called it the genetic source and nothing more. I mean to say that in my theory those two lakes belong to the system of the Sutlej. That is the important thing, not whether any other of those rivers coming from the north have more water or not.

Mr. Thomas Webber never pretended to have discovered the source of the Brahmaputra; he simply says (p. 129), "Here were the sources of the great Brahmaputra originating from the glaciers of Gurla," and he tells us that the Indus, Sutlej, and Brahmaputra take their rise from the glaciers of Gurla Mandhata. But Mr. Webber, if alive, would now be agreeably surprised to learn that Dr. Longstaff has suddenly discovered that Webber discovered the source of the Brahmaputra forty-five years ago. I beg everybody, who takes any interest in this discussion, to look up the sketch-map in Webber's book. Here the uppermost Brahmaputra is so like Nain Singh's map that one must almost believe the two maps stand in some relationship to each other. They are both absurd, but Nain Singh's is much better than Webber's, so far as the Brahmaputra is concerned. On Webber's map we find the words, "Snowy ranges unexplored," just in the very part where the real source is situated, and Webber's route is a good long way from there. South of Rakas Tal and Manasarowar we find the words, "Sources of the Indus," but I don't know whether Dr. Longstaff regards Webber as having discovered the source of the Indus. Only when my maps are worked out and published will I be able to show the value of Dr. Longstaff's communication that Webber was the first traveller to reach the source of the Brahmaputra. Webber has never been to the source of the river, nor has Nain Singh or the Gartok Mission. I am the first who has been up the Kubi-tsangpo, a river that is four and a half times as big as the Maryum-chu.

I should like to say one word about a matter which has not been under discussion to-night, with reference to a letter which has appeared in the *Standard*. It was about the maps, very well known by historical geographers, which have been painted on the walls of the Ducal Palace in Venice. I need only say Prof. Mittag-Leffler, of Stockholm, asked Prof. Volterra in Rome to make an investigation into the matter, and that he sent a rather detailed description, together with photos of those maps, and that the chief librarian of the Royal Library at Stockholm, Dr. E. W. Dahlgren, gave me some other very interesting communications about them. Those four maps were painted in the middle of 1500 by Gastaldi in place of some maps which were destroyed in 1483, and those four maps represent Asia, from the mouth of the Indus to China, the Pacific, and a part of America. The second is Western Asia, the third Africa, and the fourth Italy. I do not need to say that nothing on the map of Asia is like the reality. The Asiatic maps were renovated in the middle of 1700 by Grisellini, and the mountains and rivers form a very hopeless confusion. It is impossible, for instance, on the map of Tibet to tell which mountain range is meant to be the Himalayas, and which river is meant by the Ganges or Brahmaputra, so everybody will understand that those maps, as far as Tibet is concerned, have no value at all. Moreover, as we know they were painted just to immortalize the memory of Marco Polo, and the memory of some other Venetians, and as neither Marco Polo nor any other Venetian of that time ever were in Tibet, it is very easy to understand that these maps could not possibly contain anything that has been found by me during my last journey.

Finally, I give my heartiest thanks to the President for the most flattering and amiable words he has addressed to me. He touched upon one extremely interesting problem of the physical geography of Tibet, namely, the desiccation of the lakes. I think the fact that the erosion of the sea-going rivers enters more and more into the heart of the continent is one of the causes why the salt lakes dry up. But we must remember that it is not only the salt lakes of Tibet, but the salt lakes of the whole of Asia that are drying up; so it is not a local problem, but the root and cause of this phenomenon must be sought for somewhere outside our planet. I am very glad to hear that the President agrees with me to the name of Trans-Himalaya, and I hope the Royal Geographical Society will accept it.

I take the liberty to mention one other matter which does not belong to this discussion, but anyhow to the subject of it. The *Pioneer* of February 6 contains an article—"The Sven Hedin Mountains," signed "Astrabadi." This article does not contain a single important or original point of view, so I need not waste time on it.

Before I finish, I should like to ask one question—What is the result of this discussion? I will leave it to everybody present to reply to it in silence for himself. I have my own opinion. But I agree with the President, the material has to be published before any one is in a position to judge it. It is surprising that certain people seem to believe that I should have begun this expedition without knowing exactly what was left to be done. I started on my fifth expedition rather well prepared, and I had decided to do my utmost to find the source of the Indus and the Brahmaputra, and to fill up as much as I could the great white patch of absolutely unknown country north of the Tsangpo. I have done it now, and I have solved many other problems of physical geography which have not even been mentioned during this discussion.

III. SCIENTIFIC RESULTS OF DR. SVEN HEDIN'S EXPEDITION.

By Lord CURZON of KEDLESTON, G.C.S.I., G.C.I.E.

I HAVE been asked to say something about the scientific results of Dr. Sven Hedin's latest and greatest journey. I have great pleasure in doing so. I only regret that I did not enjoy the opportunity of giving to Dr. Hedin greater official advantages and encouragement than he received in the earlier stages of his journey —as I had promised to do had I remained longer in India. There is one feat of Tibetan exploration still unachieved, of which I should like him to have carried off the laurels. On the other hand, the disheartening circumstances in which he started were in reality the cause of some of his greatest achievements in his latest journey, and thus "it is an ill wind that blows nobody any good."

I venture to place Dr. Hedin's discoveries, which are, I think, the most remarkable in his long and unequalled career of exploration, in three categories of merit. The highest ambition of a geographer is to add to the sum total of human knowledge by filling a blank space on the map, or erasing some speculative error that may hitherto have disfigured it. First, accordingly, I should be disposed to place his filling up of that great "white patch" of 65,000 square miles, between the Tsang-po and the Central Tibetan plateau, stretching from Gartok on the west to Shigatse on the east, and containing the hitherto unknown Tibetan provinces of Bongba and Chokchu.

Alongside of this great discovery I would place the tracing for hundreds of miles and the assurance of a definite orographical existence to the mighty mountain palisade or series of palisades to which he has, in my opinion very appropriately, given the title of the Trans-Himalaya. This range has been surmised to exist in its entire length for many years; it has been crossed at its extremities by Littledale and by native surveyors. But it was reserved for Dr. Hedin to trace it on the spot and to place it upon the map in its long, unbroken, and massive significance—its peaks a little less high than the Himalayas, but its passes much higher, its normal width nearly 100 miles, its total length at least 1000 miles, nor improbably, if its extremities could be followed, nearly twice as much. It is no mean addition to human knowledge that we should realize the assured existence of one of the greatest mountain masses in the world. As regards the name which Dr. Hedin has given to it, I will only say that the desiderata for the title of a new and momentous geographical discovery appear to be these: (1) that the name should if possible be given by the principal (Dr. Hedin would not say himself that he was the sole, or even the first) discoverer; (2) that it should not be unpronounceable, unwriteable, over-recondite, or obscure; (3) that it should if possible possess some descriptive value; and (4) that it should not violate any acknowledged canons of geographical nomenclature. The name Trans-Himalaya combines all these advantages, and it has a direct Central Asian analogy in the Trans-Alai which is a range of mountains, standing in the same relation to the Alai, that Trans-Himalaya will do to Himalaya. I am not in the least impressed by the fact that the name was once given to another range, where its unsuitability secured its early extinction. Any attempts to substitute another title on the present occasion will, in my opinion, be foredoomed to failure.

Second in order of importance, I would place the discovery of the true source of the Indus. There can be no doubt that Dr. Hedin is the first European traveller who has traced the main branch of this mighty river to its glacial origin. Native wisdom is by no means to be despised in such matters, and the Tibetan title of Singi-ka-bap shows that local information, based on the experience of centuries, is in accord with Dr. Hedin's thrilling discovery.

Third, I should be inclined to place what I would call the determination, rather, perhaps, than the discovery, of the true sources of the Brahmaputra and the Sutlej. When a traveller visits or ascertains or sees something which no one has visited, ascertained, or seen, or perhaps even suspected before, he discovers. When he pursues earlier investigations a few stages further, on lines already followed and accepted but not carried to their logical or geographical conclusion, he determines. Thus Livingstone determined the central course of the Zambesi, but he discovered the Victoria falls.

The range of Dr. Hedin's achievements in this wonderful journey is a fitting crown (unless he has yet further ambitions) to the triumphs that have won for him the first place among living Asiatic explorers. I would only add that when disputes are raised, either as to the facts of discoveries so important, or as to the inferences to be drawn from them, I think that it argues some presumption to reject the judgment of the man who narrates what he has seen with his own eyes and done with his own hands—more particularly if he possesses the unequalled record and the unique intellectual and scientific equipment of Dr. Hedin.

IV. WHAT WE HAVE LEARNT FROM DR. SVEN HEDIN.

By Colonel Sir T. H. HOLDICH, K.C.M.G., K.C.I.E.

The great traveller, Dr. Sven Hedin, has spoken from the London stage and passed on to repeat to wondering audiences the story of his marvellous adventures elsewhere. His amazing energy and determination (before which the hedge set up between India and Tibet by the Indian Government was but an obstacle of straw), his indefatigable patience and keen powers of observation, his fluency of speech, and the charm of his personality win him applause and admiration wherever he goes, and the congratulations of his friends surround him like incense. It is too soon to expect that we should learn even a tithe of the mass of interesting facts that must result from such wide extended research and such intimate association with the natives of Tibet. There is hardly a branch of science to which Sven Hedin is not capable of adding new and valuable information, but it must be years before he can collate and sift his facts and observations so as to place before the public even an epitome of the scientific results of his self-imposed mission. It is not, however, with the general character of his observations in the many branches of science to which he has devoted his attention that I wish to deal at present. I am but taking count of what has fallen from his lips in explanation of his position of a geographer, and in matters geographical we have, at any rate, a certain slight foundation on which to base an elementary criticism—if not of his results, at least of his methods of attaining those results. There was much point in the concluding remarks of his address at Queen's Hall, when he thanked Lord Morley for the legislation which prevented any interference with his work whilst filling up what he called the white space in the map of Tibet. But for that determined attitude of the Government of India on the subject of crossing the Tibetan border, it might well have happened (as Dr. Sven Hedin suggested) that we should by this time have secured a scientifically constructed geographical map of all that "white" space, and the question naturally arises, What shall we get from Sven Hedin?

In these later days, when the white spaces of Asia are so restricted and there is little or nothing left to "discover," it cannot be too strongly insisted on that satisfactory geographical map-making must necessarily be based on two scientific functions, *i.e.* triangulation, which means the accurate fixing by observation and

mathematical deduction of certain points and features on the Earth's surface; and topography, which means the accurate delineation *on the spot* of the features of the county relating to these triangulated points. Nothing short of this is the requirement of scientific map-making in these days, especially in the military field, and the conditions which render these processes impossible relegate all other map-making to the position of a temporary makeshift awaiting better opportunities. Neither triangulation nor topography (in the strict sense) formed any part of Sven Hedin's methods, although the conditions of travelling in that country are not such as to exclude either. Bower, Deasy, Rawling, Ryder, and Stein (especially Stein) have all effected excellent mapping with the theodolite and plane-table in Tibet, and so far we cannot but regret that no such results are forthcoming from Sven Hedin. For not the least advantage of the modern system of topography by use of the plane-table is that the map grows under the hand of the explorer as he travels, and he emerges from his labour with completed results dependent on no further efforts of memory and liable to no errors introduced by the difficult and uncertain processes of subsequent compilation. Sven Hedin's geographical survey methods may be compared to those of the old Indian native explorers who first traversed Tibet, and still hold the record for patient persistency in a certain class of exploration. That grand old pundit Nain Singh (to whom Sven Hedin occasionally refers), when he first crossed Tibet, had in front of him a white space indeed—for it was the whole of Tibet! Lhassa was his objective, and Lhassa he attained. As he moved eastwards from Ladak on that surprising venture, he could only be compared to Speke making for the source of the Nile. He had nothing to guide him, no previous intimation of what he would find *en route*, and a very full assurance of hostility to be encountered every yard of the way. To the south of him he saw the glittering pinnacles of that Tibetan mountain system which forms the northern water-parting of India, and he fixed the position of some of them. The inference that these were part of that great water-parting and not isolated peaks was overlooked, and geographers came to regard the Tibetan plateau as a huge uplifted series of steppes, of which the Himalayas formed the southern revetment, reaching down step by step to the plains of India. Nain Singh could not turn aside from his more important objective to examine the nature of this central divide; that was left for Sven Hedin, and we now know that the northern rim of the Indian basin is a mountain system as fully developed as the Himalayas, and in all points, except that of altitude, more extended.

The value of the work of these old explorers for purposes of compiling a map of Tibet depended on the accuracy with which they could preserve their position. This again depended on their distance measurements, and, incredible as it may seem, these measurements were maintained by the monotonous, unending, process of counting their paces through every yard of the thousands of miles of their wanderings. From day to day, from year to year even, the same perpetual counting, counting; dropping a rosary bead at every hundred paces, starting again as the weary round completed the tale of the necklace; unresting, unhasting, till the effort became mechanical (a function of the body rather than of the mind), did this extraordinary record continue, until finally the traverse came to an end in some point fixed by the Survey of India. No European could have done it; but the native did, and the result was extraordinary. Even allowing for the tendency for errors in pacing to compensate themselves, there was always a most satisfactory agreement when the long (sometimes years long) traverses were worked out. Consequently, in the processes of map compilation these records still stand as authoritative, only displaced where scientific geographical surveys have been run, and quite undisturbed by the usual sketchy forms of European exploratory traversing. So

far as we know at present, no such direct method of measurement was adopted by Sven Hedin any more than triangulation or the determination of altitudes with the theodolite, or the delineation of natural features by local topography.

It is, perhaps, too soon to speculate on the actual geographical results which he has attained by other methods, but he makes great mention of "panoramas," some 2000 of which he has sketched (presumably by eye) from such positions as passes or other elevated points in his route—and we may well ask what use he proposes to make of these. How far will they assist his mapping? Photographic panoramas have indeed often been made very useful. Combined with special instruments, and taken from positions well fixed by triangulation, they can be utilized for subsequent topography, and under certain conditions, dependent chiefly on the necessity for extreme rapidity of action (in cloudland, for instance), they are invaluable, although it is doubtful whether photo-topography will ever rival the ordinary method of mapping direct from nature itself. Photographic panoramas were found exceedingly useful, again, in illustrating the nature of that much-discussed divide which parts the Atlantic from the Pacific in South America, where they told a tale which could have been told in no other way, but they did not assist map-making. Another more remarkable series of panoramas which I can call to mind were those taken by Mr. Griesbach, the geologist of the Russo-Afghan Boundary Commission in 1883–85. Griesbach was an artist (as is Sven Hedin), but he trusted nothing to eye sketching. He worked with the camera lucida, and the skill with which he seized on all those small outward and visible signs which betokened certain geological conformation, and finally retained in a plain black-and-white drawing a distinct impression of perspective and distance, was most admirable. But although he was a sound topographer, he never made use of such panoramas for map-making. Indeed, he was a consistent opponent of what he called 'reminiscent' topography—*i.e.* topography put together after the country it illustrated had passed from view. It is, therefore, still a little difficult for us to forecast the geographical results (expressed in mapping) of Sven Hedin's great exploration. Undoubtedly he will fill up a white space in the map of Tibet, and we shall, in time, be in a better position to criticize those results.

The splendid reputation which Dr. Hedin has built up for himself is not affected by comparatively minor details of method in the prosecution of any one branch of scientific research, and he is able—no one better—to maintain his position as a scientific geographer in his own way. But there is a danger that the very glamour of his achievements should lead younger generations of explorers (not possessing his remarkable topographical memory and artistic skill) to adopt methods which, at any rate, are not those which the Geographical School has set itself earnestly and resolutely to teach, and which may very possibly have been forced on Dr. Sven Hedin by circumstance rather than by choice. It may be suggested that possibly the Geographical School want too much, but recent experiences hardly justify such a view. It happens that another great explorer (a scientist of equal rank with that of Dr. Sven Hedin) has but recently returned from Central Asia with a truly magnificent geographical record. Dr. Stein is a skilful observer himself, and an excellent triangulator. Assisted by a trained native topographer under his constant supervision, he has placed no less than 130 sheets of the standard "degree" size of completed mapping on the scale of 4 miles to 1 inch in the Survey Office at Dehra Dun, to be reproduced as fast as Colonel Burrard can publish them. This magnificent geographical "bag" is the result of two years' work, and, knowing Dr. Stein's previous records, I can confidently say that his is the sort of geography that we want.

V. REPLY BY DR. SVEN HEDIN.

Sir Thomas Holdich calls his article "What we have learnt from Dr. Sven Hedin. As I have followed now the same methods as during my former expeditions in Asia, the author probably means *all* my journeys. It is interesting to compare this article with the opinion he expresses about my journeys in his own book, 'Tibet, the Mysterious.'

So far I have only had time to read a paper about the last half of my journey (in Queen's Hall), and later in a more technical paper—more especially about the results of other travellers in Tibet. But it will take me three years to work out all the scientific results, and until this is done it is curious that anybody should take the trouble to write criticisms about those results.

As I am lecturing all over Europe, I have no time to enter in any detail upon Sir Thomas Holdich's article, but there are some points on which I must say a few words in reply. Sir Thomas Holdich says that the conditions of travelling in the country did not exclude the possibilities of triangulation. If the conditions were such, it is wonderful that the British in India have never sent out any expeditions to the unknown country north of the Tsangpo. In reality the conditions were such, that I had to travel a great deal in disguise, and I cannot see how a triangulation of the country should be possible under such conditions. In another critical article the same author asks why I did not take Russian topographers with me when the Indians I had asked for, and whom Lord Curzon so kindly had promised me, were refused. This question is probably only meant as a joke, so I don't reply to it at all.

Sir Thomas Holdich regrets that I did not carry out the same trigonometrical mapping as Bower, Deasy, Rawling, Ryder, and Stein. They had all native surveyors with them, and all the moral and substantial support from India which had been refused to me. I had not even a single man as an escort. Then the circumstances of travelling in those parts where the explorers mentioned have been are extremely different from those in the province of Bongba.

Sir Thomas Holdich compares my methods with those of the Indian native explorers. He has never seen my methods, so he has no right whatever to judge them; but regarding all the praise he gives to Nain Singh's work, one may get the impression that my work is at least as good as Nain Singh's. He seems to believe that only Nain Singh had a lot of difficulties to overcome, but that I had none at all. The "glittering pinnacles" Nain Singh saw to the south are by no means situated upon the Indian water-parting. They are situated on another range north of the water-parting. It is difficult to understand how Sir Thomas Holdich, who has not the slightest idea of the geography of Bongba, can express an opinion about the situation of the water-parting; but it may be interesting in this connection to note that the same author twice in his above-mentioned book believes that the great lakes of Nain Singh drain to the upper Brahmaputra. This proves, however, what vague ideas Sir Thomas Holdich has of the situation of the water-parting.

How does Sir Thomas Holdich know that I did not determinate the altitudes with the theodolite, nor delineated the natural features by local topography? It would have been wiser of him to keep to himself such reflections, but as he has given publicity to them without having got a word of information from me, I am very sorry to be obliged to address him publicly in this way. As to the value of my maps, I should advise those interested in this question to look up the two folio volumes of maps I brought home from my last journey, and to compare them with the maps of the pundits. Then they ought to compare what Dr. B. Hassenstein says of my maps from my journey 1893–97 (in *Pet. Mit.*, Erg. Band xxviii.), and

what Dr. Stein said of the same maps in his lecture, March 8, before the R.G.S. —with Sir Thomas Holdich's criticisms. Dr. Hassenstein worked out those maps, and Dr. Stein found the ruins near Lop-nor and the end of Keria-darya by help of them, so they have, anyhow, had more occasion to be familiar with them than Sir Thomas Holdich. And since then my methods of topographical survey and astronomical determination have improved considerably.

I hope nobody will be so extremely childish as to suppose that I do not understand the difference in exactitude between the first mapping of a pioneer in an absolutely unknown country and the careful detailed work of a general staff or a Survey of India. But I cannot understand how two such things can ever be compared by any serious man. And I cannot understand how anybody can be so absurd as to blame me, or "regret," as it is called, that I did not introduce trigonometrical mapping in the blanks of the map of the Bongba country. With the same right somebody may blame me for not having started some gold-mining companies, and built some cathedrals on my way through Bongba.

To Sir Thomas Holdich triangulation seems to be all. There are some other sciences a traveller in an unknown country has to serve. As I could not possibly do everything myself, being alone, I had to do as much as I could and as the length of the days allowed. It was my wish to take three native assistants with me, and I should have paid them myself, but the British Government refused me them. So if Sir Thomas Holdich has to blame anybody, it is rather the British Government.

To possess a preliminary sketch-map of a country is better than to have no map at all. I have been able to follow and draw the principal geographical and orographical lines of Bongba, and I have several geological profiles from Bongba, together with specimens of rock with dip and fall—a science which has been utterly neglected by most of the British travellers mentioned by Sir Thomas Holdich. There have been thousands of British officers in India during the last hundred years, but not *one* of them has ever tried to enter Bongba, a country of which Sir Thomas Holdich positively says that the conditions of travelling did not exclude triangulation work. Is it really possible that they and their chiefs could take so little interest in a country which was situated so close upon the Indian frontier? So, as to Bongba, and whatever the value of my maps may be, I suppose I have done more for our knowledge of this province than all those thousands of officers put together and, inclusive, Sir Thomas Holdich.

A child of a primary school in Sweden will understand that there is work enough to do in Bongba for generations of topographers and geologists—in those two sciences there is still a good deal to do even in England, Scotland, or Sweden, I suppose. But the very first traveller who, under exceptionally difficult conditions, enters an unknown country and brings home with him the first knowledge of it, should be the very last to be blamed for his work.

A PROPOSED NORTH POLAR EXPEDITION.*

By ROALD AMUNDSEN.

"By far the most important task left for geographical research to perform in the Arctic Regions is the exploration of the extent, depth, and character of the polar basin. A great part of this work could be accomplished by drifting through the unknown part of the polar basin —as the *Fram* Expedition did in 1893–96—north of the *Fram's* route."

* Royal Geographical Society, January 25, 1909.

These words were spoken by Prof. Nansen in his lecture before the Royal Geographical Society in London on April 29, 1907. There can scarcely be any difference of opinion on this question. The great polar basin is still lying there with its many unsolved problems, and seems to challenge us; and in our own minds we know perfectly well that we shall not give up until all these problems are solved. Nansen's drift in the *Fram* was an epoch-making event in the history of North Polar research. It showed us clearly and distinctly the only way in which the exploration of the polar basin could be accomplished—so clearly and distinctly that I have often and often been astonished that not *one* of the many who have since endeavoured to penetrate the mystery has profited by its teaching. But that is not all. It raised the veil that covered the Great Unknown, and showed us how much there was to be done. Side by side with the important results of this great expedition—perhaps, indeed, in front of the results—is the experience gained by the leader of the expedition. It was while drifting across the Polar sea that Prof. Nansen's eyes were opened to the numerous great defects that attached to the old methods of observation in use in the field of oceanic research. Since his return in 1896, he has contributed greatly to the creation of precise methods that have raised this branch of science from a more or less close approximation to a very high degree of accuracy.

If you take a map of the world and glance at it, you will at once be struck by the proportion of land to water. While the mass of known land only amounts to one quarter of the Earth's surface, the remaining three quarters consist of sea. In order to put this in a still clearer light, I will mention a few figures.

The entire surface of the Earth measures 196,740,000 square miles in area, of which 141,011,000 square miles is sea, and 55,729,000 square miles land. The unknown region round the North Pole amounts to 1,930,000 square miles. The extent of the Polar sea is about 5,790,000 square miles; that is to say, seven times larger than Greenland and twenty times larger than the Scandinavian peninsula. The North sea has an area of 193,000 square miles, or thirty times less than the Arctic ocean. The highest measured mountain, Mount Everest, is 29,002 feet in height, while the greatest observed deep, Nero deep, near the island of Guam in the Pacific ocean, is 51,615 feet (5269 fathoms, or about 6 miles).

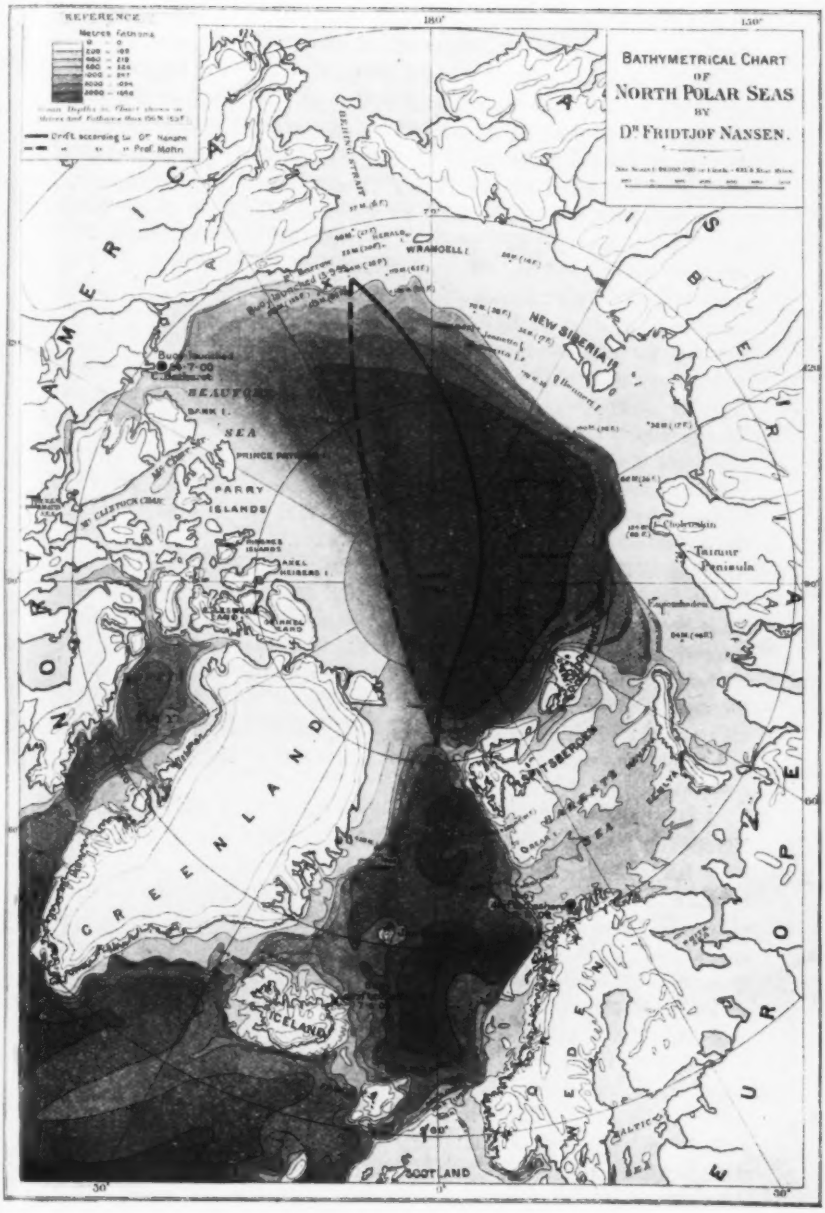
It will be clearly apparent from these figures how small the amount of land is in comparison to the sea. It is, therefore, astonishing that men have not given more attention to oceanic exploration than has been the case. If you look at a list of the various exploring expeditions that have been undertaken in past years, you will soon see that only a very small number of them have had oceanic research as their object. It is a significant fact, too, that when "discoveries" were

mentioned, it was always land that was meant, never sea; and an expedition that returned without knowledge of new lands, but only reported new seas, was considered to have yielded only negative results. That this was the case with the earlier expeditions is quite understandable. The hope of gain and power was the motive force, and this could naturally only be gratified on dry land. No one saw the importance of the great ocean. It thus happened that most of the land was discovered and made known in a comparatively short time. But with the growth of culture, the exploration of the ocean came to be looked upon as quite as great a necessity as that of the land. The interest in the unknown depths of ocean increased greatly when the Atlantic cable came to be laid. And since the middle of last century, several large expeditions of this kind have gone out. Among the most important of these may be mentioned the *Challenger* Expedition, 1872–76, under Sir Wyville Thomson and Sir John Murray, and the Norwegian North Atlantic Expedition in the *Vöringen*, under Profs. Mohn and Sars, 1876–78.

The Fram Expedition, as I have already said, was of very great importance in many respects. The fact, however, that Nansen did not wholly succeed in solving all the problems that the polar basin presents was due to the defective oceanographic methods of that day. It will be another matter now, after the progress that the science of method has lately made. An expedition with a modern equipment will be able to make its way into the polar basin with every prospect of being able to clear up much that is still incomprehensible to us.

I will now endeavour to set forth the problems that such an expedition will encounter, their significance and the manner in which they are to be solved.

When Nansen went out in 1893, he supposed, as he himself says, that he would find a comparatively shallow Polar sea, and had not, therefore, provided himself with sounding apparatus for great depths. It proved, however, that this assumption did not hold good. Instead of the shallow Polar sea, he found a sea with depths of as much as 2187 fathoms. Sounding under these circumstances was a very difficult matter. We probably all remember the exertions of the *Fram* men to procure sounding lines for these great unsuspected depths; but they managed it, and made a number of very important soundings, which showed us that there was work enough to do here. They could not, however, with their primitive implements, satisfy the requirements of modern oceanic research. Nor was the one line in which the *Fram* drifted sufficient to determine the appearance of the entire sea; and we therefore still know nothing with certainty concerning the size, the form, and the greatest depths of this deep basin. The methods of deep-sea sounding are now very good. By the aid of piano-wire and a winch with gearing, soundings of very great depths may be made in quite


REFERENCE
Metres fathoms
0 – 0
200 – 109
400 – 218
600 – 328
800 – 437
1000 – 547
2000 – 1094
Green Depths in Chart shown as above and Yellow thus 0 to 1547
Drift according to Dr Nansen
" " " Prof. Mohn
180°
150°
BATHYMETRICAL CHART
OF
NORTH POLAR SEAS
BY
Dr FRIDTJOF NANSEN.
AMERICA
ASIA
EUROPE
GREENLAND
ICELAND
SCOTLAND
NORWEGIAN SEA
BARENTS SEA
KARA SEA
BEAUFORT SEA
BANK I.
PRINCE PATRICK I.
PARRY ISLANDS
WRANGELL I.
NEW SIBERIA I.
Taimur Peninsula
Buoy launched 1893 A.D. 7° 00
Buoy launched 1894 A.D. 7° 00
Buoy launched 1895 A.D. 7° 00
Buoy launched 1896 A.D. 7° 00
Buoy launched 1896 A.D. 7° 00
Buoy launched 1896

a short time, where the *Fram's* men would have toiled and slaved for days.

We have here (p. 443) a chart of the bottom of the Polar sea and adjoining waters. The land here is white, and the various tints indicate the depths. Depths of more than 2000 metres (1093 fathoms) are black. As regards the Polar sea itself, the only certain parts are those that lie along the line taken by the *Fram;* all the rest is guess-work. The deep part of the basin is bounded by comparatively steep edges, just as in the Norwegian sea; and between the edge and the shore there are flat banks of various widths. We notice the great continental shelf to the north of Siberia, where these shallow places are of much greater extent than in most other parts of the world. The continental shelf to the north of America we are still unacquainted with.

Nansen, after his investigations with the *Fram*, has assumed that there is a ridge running from the north-east of Greenland to Spitsbergen, which separates the deep parts of the Norwegian sea and the Polar sea from one another. The beginning of this ridge on the Spitsbergen side has been proved by soundings; and the discovery, by the *Denmark* Expedition, of a peninsula that stretches eastwards in 81° N. lat. seems to strengthen this assumption.

These different topographical questions—the appearance of the continental shelf, the extent, form, and depths of the basin itself, and its transition into the surrounding deep seas—are questions of special interest. The complete charting of this immense basin will not, of course, be effected in a single expedition similar to the first *Fram* Expedition, even if the course of the drift were quite different to that taken by the *Fram;* but the material that might be procured by such an expedition would be a valuable aid in the clearing up of the questions.

During the last few years, apparatus have been constructed, by Nansen and others, that can take samples from the bottom of the sea in such a way that not only the uppermost layer of ooze or mud can be examined, but also other layers below that, to the depth of a couple of metres. The various layers of deposit can thus be seen, sometimes animal and vegetable remains, sometimes fine sand or other organic material. In most places, several such layers are found one above another, and they can then tell the history of long ages, in the same way that geological stratification with its fossils can do on land. Of late years such stratification of the deposited matter has been found in many places, such as the deeper parts of the North sea, the Skagerak, the Atlantic, and the Pacific. It tells of great changes that have taken place in the ocean basins, and of great variations in the temperature of the sea-water, and much more besides. It is just in a sea like the Polar sea that such investigations will be of great interest. One naturally thinks of what geologists have found regarding the varying

climatic conditions in Siberia, Greenland, on the Scandinavian peninsula, and in many other places. The earlier expeditions have not had the necessary apparatus for such investigations; but now we have them, and all that is needed is that they shall be used.

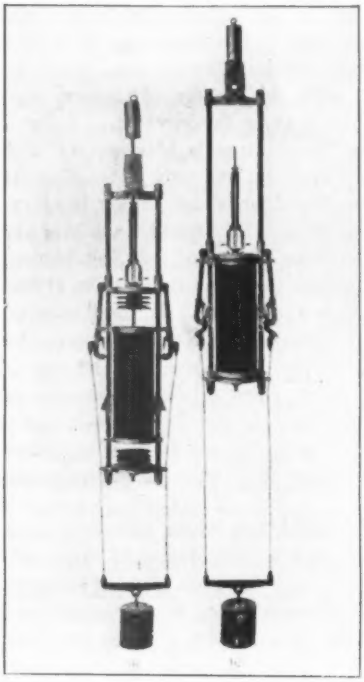
I have endeavoured to put before you briefly some of the problems that it would be interesting to have investigated as far as the bottom of the polar basin itself is concerned; but it would be still more important to have the enormous volumes of water that fill this basin examined by means of the aids now at our disposal.

With the reversing thermometers of the latest construction, the temperature can be determined anywhere in the sea and in all depths with an accuracy of $\frac{1}{100}$° C. The latest investigations in the Norwegian sea, for instance, have been made with this degree of accuracy, and among other things it has been found that in the stratum, at a depth of between 546 and 820 fathoms, the temperature is between -1° and $-1{\cdot}3$° C. In the deepest strata it is uniform and quite constant. At the bottom of the Polar sea, Nansen found somewhat higher temperatures, about $-0{\cdot}9$° C. This was one of the things that made him put forward his hypothesis of a ridge between Greenland and Spitsbergen. Further, his observations seem to indicate that the temperatures at the greatest depths rose somewhat towards the bottom. If there were no such ridge between Spitsbergen and Greenland, as Nansen assumes, the difference between the bottom-water of the Norwegian sea and that of the polar basin might be explained as an effect of the temperature of the earth; but as the salinities, according to the determinations, are higher in the polar basin than in the Norwegian sea, it does not appear to be the same kind of bottom-water; and this indicates the existence of a ridge.

These questions still remain unsettled, but might be settled now that the instruments have attained such a high degree of exactness. Measurements of temperature, together with determinations of salinity, are the most important means for the determination of the extent and origin of the various strata of water. The salinity of water from any depth can now be determined with very great accuracy.

Here (p. 446) we see a couple of the more modern water-bottles that have been constructed within the last few years. They take absolutely reliable samples of water from every possible depth, and work with certainty and ease. Determinations of the salinity of water-samples can now be made with an accuracy of $\frac{1}{100}$ per mille; whereas formerly one had to be content with an accuracy of $\frac{1}{10}$ per mille, and often even less than that. The variations in the salinities of the Polar sea, from 100 fathoms or so below the surface to the bottom, are very slight, less than the inaccuracies in the determinations with the older methods; but though slight, they are still of decided importance for a comprehension of the different origin of the various water-strata.

We here (p. 447) see a section from the New Siberian islands, through the Polar sea towards Spitsbergen and into the Norwegian sea, drawn after Nansen's investigations. To the right are the flat, shallow banks, which end at the edge of the Polar sea. On the left is the deep polar basin. On the surface there is water with low salinity and temperature between 0° and −1·9° C. It forms the real polar current, the current with which the *Fram* drifted. It is due in a great degree to the precipitated water from Asia. This stratum of water is nearly 110 fathoms thick. Beneath it comes another, warmer layer. The maximum temperature of this layer decreases regularly from Spitsbergen towards the New Siberian islands. The layer extends from 110 fathoms down to about 440 fathoms. Then finally, lowest of all, comes the deep stratum of cold bottom-water. These three different strata of water form at least as many different current-systems; but for a full comprehension of these minute investigations will be required with our newest instruments.

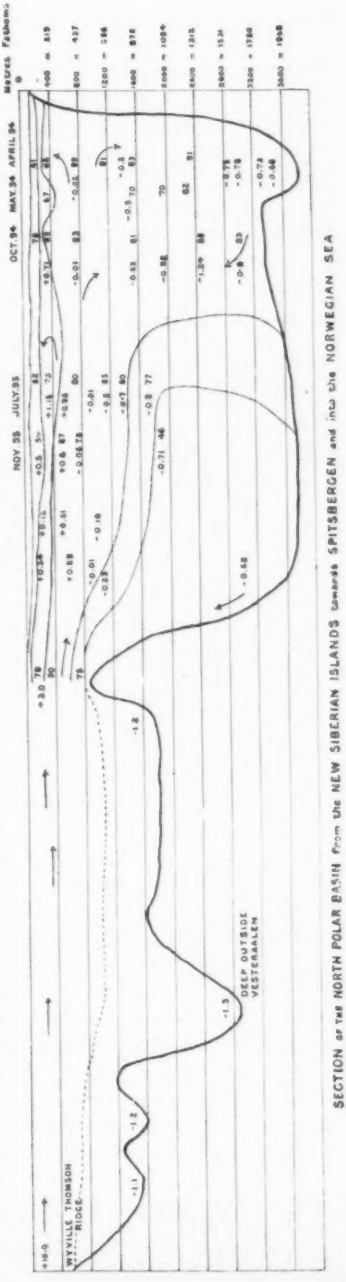


NANSEN-PETTERSEN WATER-BOTTLE.

Before going any farther, I will say a few words on the subject of some remarkable observations that were made during the *Fram* Expedition in the Polar sea, and the cruises of the *Michael Sars* in the Norwegian sea. It appears that the salinity and temperature at a certain depth may vary in the course of quite a short time. The salinity and temperature that might be found, for instance, at a depth of 11 fathoms, were soon after found at a depth of 8 fathoms. In the Norwegian sea it has further been proved that exactly the same conditions may be found at one station at a certain depth that are found at neighbouring stations—on either side—at quite different depths. The difference in depth may be 30 fathoms, or it may be 110. There are two possible explanations of these phenomena. To some extent these apparent irregularities or changes in the depths of the strata are due to submarine or intermediate waves, which occur at the boundary between two strata of water, and

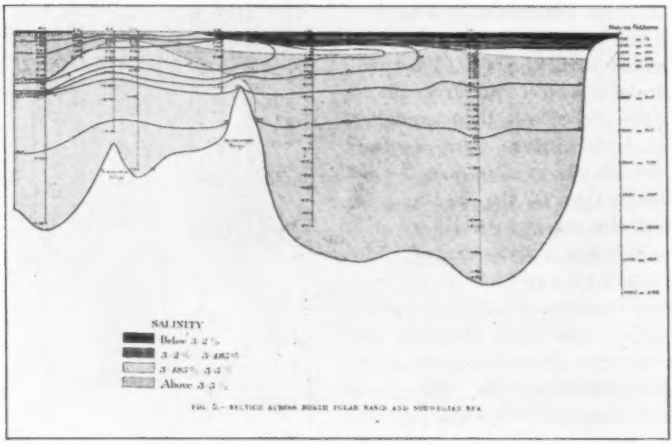
may often attain greater dimensions than the waves with which we are acquainted on the surface of the sea, at the boundary between the water and the air; and to some extent they may be due to vortex motion on the borders of two volumes of water, moving with unequal velocities or in different directions. The latter explanation will probably be the correct one of the great irregularities. Movements of this kind must continually occur in the sea, and have a very important part to play. They will more easily be studied from the ice on the Polar sea than anywhere else, both because there a steady point of observation can be obtained—that is, the ice—and because the marked stratification of the volumes of water makes it easy to follow all variations at the transition from one stratum to another.

The currents in the deep seas have never been investigated by direct determinations. The reason of this has partly been that hitherto we have not had good and sufficiently accurate current-gauges, but more especially that on the sea it is not generally possible to obtain a steady point from which to make observations. A vessel on the open sea will, as a rule, make many chance movements that will greatly affect a current-gauge, and prevent it from giving only the movements of the water. In the Polar sea the difficulties will be much smaller. The ice is, of course, not liable to any wave-motion, and its slow drifting is even, through long periods, and may therefore easily be determined more or less exactly,



SECTION of the NORTH POLAR BASIN from the NEW SIBERIAN ISLANDS towards SPITSBERGEN and into the NORWEGIAN SEA

for instance, by the aid of current-gauges that are lowered deep enough to reach the comparatively quiet stratum of bottom-water. In this way the current-gauges may be employed as logs. From an ice-floe, whose rate of drifting is determined, the currents at the various depths may be measured, and the actual motions of the water-strata be determined. Among the current-gauges that have been constructed during the last four or five years, I will only mention Nansen's pendulum current-gauge and Ekman's propeller current-gauge (p. 449), both of which were constructed at the International Central Laboratory for Oceanic Research in Christiania. The first of these is exceedingly well adapted for determining the velocity and direction of the bottom currents, even

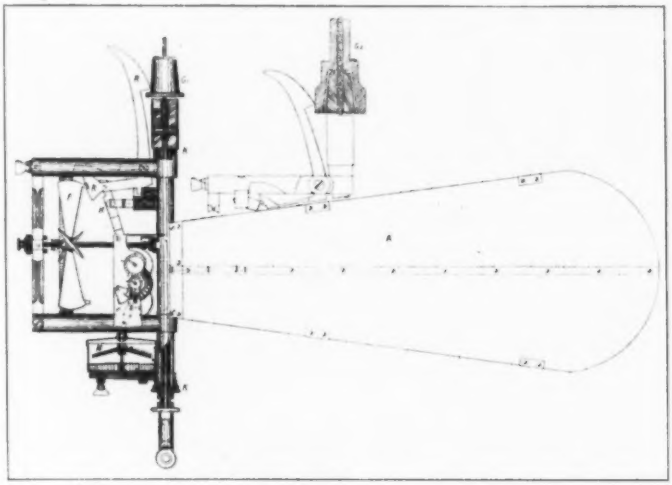


SECTION ACROSS NORTH POLAR BASIN AND NORWEGIAN SEA.

when they are very slight. The second has been much used lately to measure intermediate currents and those in the upper layers of water, in places where the entire depth has been from 250 to 350 fathoms. No reliable current-measurements have yet been made in deeper places, just on account of the difficulties in obtaining a reliable point of observation on the open sea.

These current-measurements of the last few years have yielded a series of very interesting results. I will mention some of them, chiefly as instances of the problems that present themselves for solution when the movements in the sea are in question. We see here (p. 450) a curve which represents the velocities that were measured during some investigations in one of the fjords near Bergen last summer. At a depth of 3 feet below the surface, current-measurements were made uninterruptedly for many hours; there were only a few minutes between

the observations. The velocities that were then found are represented in the figure in such a way that they can be found by the vertical scale; while the horizontal scale gives the time of the observations. One is struck by the irregularity of the curve. It goes incessantly up and down with wide oscillations. At one moment, for instance, the velocity was 11·8 inches per second, a few minutes later 17·7 inches, and again a few minutes later 9·8 inches. The current thus varies incessantly at quite short intervals. What the cause of this may be has still to be discovered; but it is evidently of the greatest importance to have this matter cleared up, if we are to understand what the sea is. And this kind of question might be thoroughly studied on the drift-ice in the

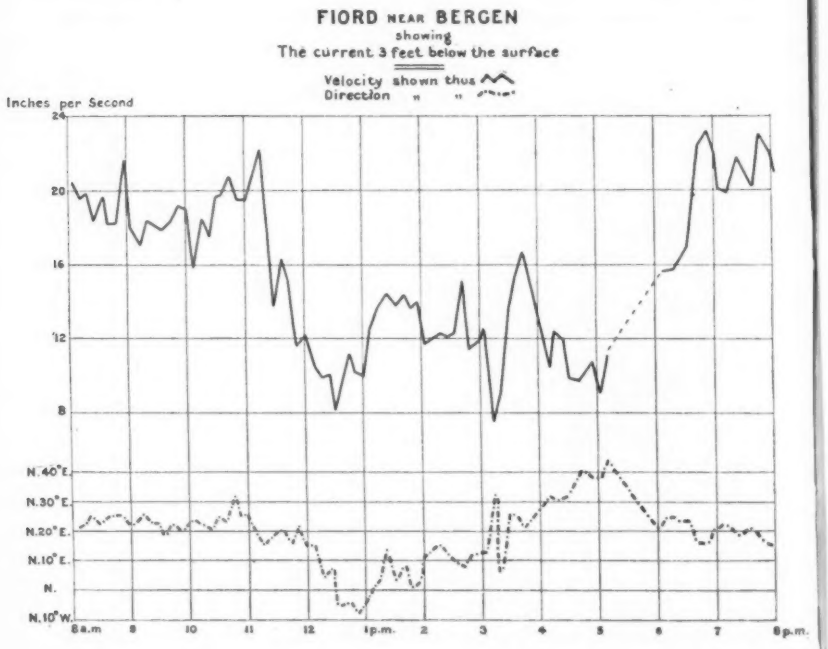


DR. EKMAN'S CURRENT-GAUGE.

Polar sea, and the ordinary movements in the various depths of that sea be determined by a multitude of current-measurements.

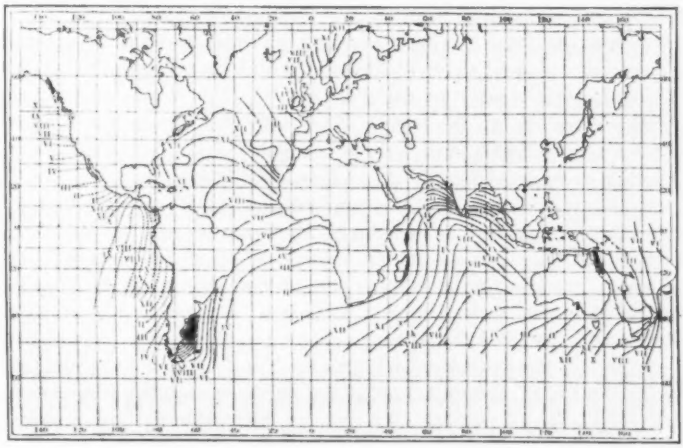
There are two or three other problems, which also merit a more detailed mention. The first of these is the phenomenon of tides, which are so well known in their visible effects, by the rising and falling of the sea, but which are still, as regards many important particulars, unexplained. High tide is due, as we know, to the attraction of the moon and the sun upon the masses of water. In the form of a great wave the high tide spreads over the sea, and this tidal wave will occasion tidal currents. The tidal currents have been studied in littoral waters, but nothing is yet known of them in the deep sea, where they have not been observed with sufficient certainty. It has

been doubted whether, in a deep sea, there are tidal currents strong enough to be observed even with finely registering instruments; but the experience of the *Fram*, that the tide regularly occasioned screwing, indicates that such is the case. The observations that we have, however, are too few to allow of any conclusion being drawn as to the advance of the tidal wave. During the drift of the *Fram*, Nansen found that the screwing of the ice occurred at regular intervals, sometimes twice in the twenty-four hours, sometimes only once. It looks as if this screwing were connected with the tide, and that there are thus tidal currents



in the Polar sea. A closer investigation of this matter would be particularly interesting in the first place in order to discover whether there are tidal currents in deep sea—a discovery that might be of practical importance to navigation—and in the second place because, according to Helland-Hansen's investigations, there may be some hope of determining the advance of the tidal wave by the aid of current-measurements. We see here (p. 451) the advance of the tidal wave along the shores of the Pacific, the Indian Ocean, and the Atlantic. In the so-called "Southern Ocean," the wave follows the moon; it is not hindered by land there, because the ocean is circumpolar. As the wave passes

the southern opening of the Atlantic it slips in there, and spreads northwards right to the shores of northern Europe. In the Atlantic itself, the moon and the sun will produce a corresponding wave from east to west; but Europe and Africa on the one side, and America on the other, will prevent the wave from attaining the size and development that it can have in a circumpolar sea. It is therefore thought that a large proportion of the changes in water-level in northern Europe are due to the wave that is developed in the "Southern Ocean," while a smaller proportion are due to the action of the moon and the sun upon the waters of the Atlantic and the Norwegian sea. But how does this matter stand with regard to the Polar sea? If it is quite



THE PROGRESS OF THE TIDAL WAVE.

circumpolar, without being interrupted by unknown land-masses, towards the pole, a tidal wave will probably be developed there, similar to that which we assume to be in the South Pacific. This wave will occasion rising and falling of the water-line, and probably cause currents. It is natural to suppose that these questions can be elucidated by the aid of current-measurements. Much would thereby be gained towards a knowledge of tides in general.

The second problem, which I will specially emphasize, is the question as to how the wind affects the currents in the sea. On the open sea the wind will easily produce waves, thereby raising a surface of attack, against which it beats, and often causes a strong surface-current. The effect is propagated downwards, but the strength and species of this effect of the wind is a much-contested question in oceanography. While some scientists think that the great ordinary ocean

currents, even at great depths, are due to the average wind blowing along the surface of the sea, others believe that as a rule the wind has little or nothing to do with such great currents, but that it only produces a more or less temporary displacement of the uppermost layer of water. It is extremely difficult, not to say impossible, to observe the currents produced by the wind on the open sea; for the wind will give the vessel so much independent motion, that it will be more difficult than usual to procure the fixed point of observation that is requisite for all current-measurements. But in this respect the Polar sea offers particularly favourable conditions. In no condition of the wind do waves arise. The ice lies as a protection to the water, but is itself driven by the wind with more or less velocity. This drifting can be measured by the modern methods, and the relation between the strength of the wind and the movement of the ice can be studied. One particularly interesting result from the first *Fram* Expedition was that Nansen found that the ice was driven off at an angle of from 30° to 35° to the right of the average direction of the wind. This deflection he ascribed to the rotation of the Earth, and further concluded that if the ice were so deflected as compared with the atmospheric currents, it must in its turn produce a current in the underlying strata of water, that would be still more deflected on account of the same rotation of the Earth. And in this way, Nansen thinks, it must continue downwards in the open sea; in some depth or other the current caused by the wind has become so much deflected, that it moves in exactly the opposite direction to the wind that produced it. Dr. Ekman has investigated the question theoretically, and has confirmed Nansen's conclusions. On the other hand, theoretical objections have been made quite recently by Profs. Mohn and Schiötz. We have no direct observations, however, of the magnitude of the currents caused by the wind, and of their propagation from stratum to stratum of the water. Nansen had no opportunity of measuring these currents, because the methods at that time were not sufficiently developed. But now it can be done, and it will be possible to study the effect of the wind upon the sea from the ice of the polar basin better than from any other place.

Before concluding this mention of the problems that present themselves in the Polar sea for solution by an expedition that is equipped with the best scientific aids of the present day, I will mention yet a few more important points. You all know that the sea contains various quantities of gases in solution. There is much to be done in a study of these gases in solution in the sea-water; but I will touch upon one thing only. It is well known that all animals require oxygen in order to live; in breathing, oxygen is consumed and carbonic acid is given off. This is also the case with plants in the dark. In the light, on the other hand, it is the opposite; plants then consume carbonic acid and produce oxygen. With regard to the sea, a number of interesting

observations have been made of the reciprocal action of animals and plants, of light and darkness. The Polar sea offers very favourable conditions for the study of these questions, with its summer one long light day, and its winter one equally long dark night. It would be exceedingly interesting to study this reciprocal action under such characteristic conditions. As aids in these studies we now have apparatus that can measure the strength of the light at the various depths of the water, both under ice and in open water. And the quantity of the little plants and animals that are found in the sea can be measured. One of the most important questions in the physiology of the ocean and the circulation of its organisms can thus be minutely studied.

In addition to the oceanographic problems here mentioned, which it will be the chief aim of my proposed expedition to solve, there are a number of other questions of almost equal importance. Closely connected with the oceanographic observations are the meteorological. It is true that the meteorological phenomena were carefully studied during the drifting of the *Fram;* but this would not prevent a new series from being of great importance. I do not expect to meet with any new remarkable phenomena, hitherto unknown—the meteorological conditions of the polar basin are probably too uniform for that; but merely as a check and for comparison with those previously made, they will be of great interest. I therefore intend to take with me a complete meteorological outfit of the most modern instruments. The investigation of the terrestrial magnetic conditions will be of less importance, but still interesting; of less importance because the unstable drift-ice affords only a bad basis for observations that demand such a high degree of accuracy as the magnetic, but still interesting as a supplement to the magnetic observations taken by Captain Scott Hansen on the first *Fram* Expedition.

In connection with the magnetic observations, the observations of aurora will be of great interest. We all know the magnificent auroras up there in the deep, gloomy polar night, from Nansen's excellent description—we know them all, those strange, flaming, shooting movements across the sky on calm winter nights—we know them all so well, and have so often admired the mysterious spectacle. No one can doubt that a remarkable force is at the back of this, a force that we human beings are determined to find, bind, and utilize.

And the polar regions are just the place for the study of these phenomena, which occur there more frequently and with greater splendour than anywhere else. Profs. Birkeland and Störmer have, as we know, made exceedingly important investigations in this field, which seem to promise a solution of these difficult problems; but by investigations continued for so long a time, valuable contributions to their study will certainly be obtained.

I have now attempted to put before you some of the problems in which the polar regions are so rich. I have, however, only made a selection, having, in particular, the polar basin in view. It is the exploration of this basin, the nucleus of the polar regions, to which we must turn all our attention. Many people think that a polar expedition is only an unnecessary waste of money and life. The idea of a polar expedition is connected in their minds with that of a record, of reaching the pole or farther north than any of its predecessors; and if that is the case, I agree with them. But I must most emphatically assert that this storming of the pole will not be the object of this expedition. Its chief aim will be a scientific study of the polar sea itself, or rather an investigation of the bottom and oceanographic conditions of this great basin. In my opinion, work with this object in view might be of very great scientific importance, for several reasons. In the first place, it will be very interesting geographically to become better acquainted with the conditions in those unknown regions in the vicinity of one of the poles of the Earth; and, in the second place, it will be an important matter to know those northern waters in their relation to the surrounding seas—for instance, the reciprocal action between the Atlantic or the Norwegian sea and the Polar sea. There is a constant interaction between these ocean regions, which cannot be fully understood until each of them has been explored.

Finally—and this is the point that will weigh more heavily in the scale in favour of an expedition through those regions—the Polar sea, in most respects, affords a far more favourable practical opportunity of studying the ordinary conditions in the sea than any other place. This is due to the peculiar conditions there—a sea 2200 fathoms deep, or even more, upon the surface of which one can move about almost as on dry land. One can live and build upon the ice, and from it lower all one's instruments into the sea, and reach down to the greatest depths, without all the difficulties with which one has to contend in storm and rough water on the open sea. There is no more ideal place to be found for oceanic investigation.

I sincerely hope that I have succeeded in so putting my views before my audience, that I shall not be the only person present who considers that a new expedition across the Polar sea is desirable. I will now briefly put before you the manner in which I have thought of exploring the polar basin. The manner is not original; we are all acquainted with it already. I have thought of employing the same mode of procedure as Prof. Nansen with his *Fram*, but, it should be observed, with the benefit of all his experience, which he has placed at my disposal. I will not weary you with a repetition of all the evidence upon which Nansen's theory of the polar current was based. We know it all so well. We now have evidence that is far more certain and better than all these little, apparently insignificant things that Nansen had taken

with great difficulty and labour from the various regions of the Polar sea, and from which he evolved his ingenious theory of the polar current, and upon it performed his splendid achievement; we have, I repeat, far more certain evidence, and that is Nansen himself. Relying upon his experience, I have determined to choose my point of departure at a considerable distance from the spot where Nansen found himself obliged to let the *Fram* begin to drift.

I intend to ask the Norwegian State for the loan of the *Fram* for my contemplated voyage of discovery. The *Fram* was built in the years 1891 to 1893, at Colin Archer's shipbuilding yard at Larvik, and was so constructed that she not only withstood the tremendous pressure of the ice to which she was subjected, but even came home without a single scratch from her long severe combat with the huge masses of ice. It has been said that after the number of years that have passed since then, the *Fram* would be rotten and unfit for further work in the Polar sea; but I can personally testify that this is not the case, for I subjected the vessel to a very careful inspection last June, at Horten. Colin Archer, the builder of the *Fram*, who was so kind as to assist me in this inspection, sent me, shortly after, the following letter:—

"In compliance with your request, I beg to impart to you my opinion concerning the condition of the polar vessel *Fram*, with regard to a further employment of the vessel, after having yesterday, together with you, inspected her in the harbour at Horten.

"During the inspection it transpired that the head-carpenter at the yard, Johannesen, who was present all the time, had already subjected the vessel to a thorough examination, both outside and in, and could point out the defects. Some of the fittings were removed in order to facilitate the examination; the masts were taken out, and in some places the ceiling was removed, where signs of rottenness appeared. The defects pointed out were examined and inspected; and further, some borings were made in other places in beams, ceiling, and frame, both between-decks and on the topsides, without bringing to light any further damage.

"In my opinion, the ship shows no sign of strain at the joints or bindings; in this respect there is no change to be discovered since the ship was built, and her strength and capability of withstanding strains may thus practically be said to be unimpaired.

"The defects that exist are for the most part local and of a kind that readily appears in any ship built of wood, after years have passed, especially when she has been laid up, like the *Fram*, during a great part of the time. Owing to her peculiar construction for a special purpose, the same consideration could not be paid in the building of this ship to the abundant supply and circulation of fresh air as in an ordinary wooden ship; and it was therefore only to be expected that certain

covered-in parts would suffer on account of imperfect ventilation. The damage is not, however, of such a nature that, when repaired, the vessel can be said to have suffered any essential diminution of solidity. I can thus express as my firm opinion that after undergoing repairs in accordance with the plan suggested by Horten Dockyard, the *Fram* will be in a perfectly fit condition to start on an expedition to Arctic waters.

"Yours faithfully,

"COLIN ARCHER."

From this it appears clearly and distinctly enough that the old *Fram* is not yet so entirely unfit for service as has so often been said latterly. Any vessel, it is unnecessary to say, that is laid up for several years, cannot but suffer from it. Blame has been thrown upon the people to whose care the *Fram* was entrusted, for not having kept her in good condition; but this criticism seems to me to be uncalled-for. With such means as were at their disposal, they have bestowed such care upon the preservation of the vessel as deserves appreciation rather than misplaced criticism.

My plan is as follows: With the *Fram* equipped for seven years, and a capable crew, I shall leave Norway in the beginning of 1910. We shall make for San Francisco round Cape Horn, taking in coal and provisions at the former place. We shall then shape our course for Point Barrow, the most northerly point of North America, which I hope to reach by July or August. From this place the last news will be sent home before the real voyage begins. On leaving Point Barrow, it is my intention to continue the voyage with as small a crew as possible. We shall then make for the drift-ice in a direction north by north-west, where we will then look for the most favourable place for pushing farther north. When this has been found, we shall go as far in as possible, and prepare for a four or five years' drift across the Polar sea. Throughout our voyage up to this point, I intend to make oceanographic observations; and from the moment the vessel becomes fast in the ice, a series of observations will be begun, with which I hope to solve some of the hitherto unsolved mysteries. What I expect to find in the unknown part of the Polar sea I will say nothing about at present. Some people have put forward theories of great masses of land, others of small. I ought perhaps also to have put forward my theory, but think it wiser to refrain from doing so until I have investigated matters at closer quarters.

The PRESIDENT (before the paper): Captain Amundsen, whom we cordially welcome here to-night, is going to describe to us his proposals with regard to a polar expedition, both as regards its methods and its objects. Captain Amundsen has had a great deal of experience in arctic work already. His first expedition was undertaken in a whaler, for the sake of learning navigation in the ice. On his return from that journey, he was appointed first-lieutenant on the Belgian vessel, the

Belgica, for the exploration of the Antarctic ocean. After his return from this expedition he conceived the idea of undertaking a magnetic examination of the region close to the magnetic north pole, and for that purpose he placed himself under Dr. von Neumayer at Hamburg, in order to thoroughly learn all that was necessary for that line of investigation. He then purchased a small ship called the *Gjoa*, and he took with him only six men, all of whom were more or less experts. He first went to the ocean between Spitsbergen and Greenland, and his researches there were of considerable value, and were afterwards worked out by Dr. Nansen. In the year 1903 he went from thence to the region round the magnetic north pole, and he devoted two years to systematic magnetic work with the best instruments in that region, the result being to largely increase our knowledge of the geographical distribution of those forces. During the stay of the expedition in those regions several expeditions were undertaken in various directions. A considerable section of the coast of North America, hitherto unmapped, was mapped. Careful investigations were made with regard to the Eskimo with whom he lived, and a good deal of scientific work was done. At the conclusion of this magnetic work, this little ship came out through the Behring straits, and thus for the first time in our history completing the north-west passage, which expedition Captain Amundsen has described in his interesting book of that title. It is, I think, clear that Captain Amundsen has already shown that he ought to be classed as belonging to the first rank of scientific explorers. This is Captain Amundsen's record as regards the past. He has, during recent years, moreover, been studying arctic problems with extreme care, not only the problems themselves, but the best method of solving them. His record shows that he is not a man to take up any project hastily or without the most mature consideration. Undoubtedly his expedition which he proposes is a hazardous one, but I think when you have heard him speak you will agree that the objects he has in view are ones of great scientific interest, including as they do the sounding and dredging of the ocean, measurements of temperature and salinity of the sea and of the movements of the ice, and many other phenomena, all of which will help us to solve various arctic problems. As to the means of effecting this work, he has the encouragement and the great example of Nansen before him. It is not for me, however, to express an opinion, either in my own capacity, or my capacity as President of this Society, on the methods he proposes for this work.

The PRESIDENT (after the paper): Before asking any one to take part in the discussion, I will ask Colonel Close to kindly read a few important communications we have received concerning this expedition.

The following communications were read:—

(1) From Dr. FRIDTJOF NANSEN: I deeply regret that pressing work here prevents me from being present when my compatriot, Captain Roald Amundsen, is going to lay his plan for a new North Polar Expedition before the Royal Geographical Society. To give an impartial opinion of Amundsen's plan is, I am afraid, impossible for me, as, on the one hand, I am too much interested in the realization of his planned expedition, and, on the other hand, I have too great an admiration of my friend Amundsen, both as a scientific explorer of the right stuff and also as a leader of men, and my confidence in him makes me believe that he is one of those that carry through successfully, in one way or another, whatever they undertake. The reason why, according to my view, an expedition carried out according to Amundsen's plan will be so very important, is that at the same time as it promises to solve the most important North Polar problems left, which are what I may call of local interest, it will afford the possibilities of solving important problems of very great general interest, especially for geomorphology and oceanography.

I may mention, as an example, the facilities which the slowly drifting ice will afford for taking a unique series of numerous and accurate soundings across the North Polar basin during those long years. On the drifting polar ice more accurate astronomical observations (for determination of latitude and longitude) can be taken than in any other region of the ocean, and also the velocity and direction of the movements of the ice can easily be measured very accurately by current-meters, lowered into the quiet bottomwater of the sea. It may thus be possible at any time to determine the accurate position of the soundings, and we may obtain a series of soundings showing in minute detail the relief of the bottom of a deep sea in a section, as we have it, from no other part of the ocean.

I may also mention the unique opportunity which Amundsen's expedition will afford of solving problems of the greatest importance for physical oceanography. We have hitherto studied the water-strata of the deep open ocean chiefly by examining the temperature and salinity (or specific gravity) of the water.

As an example illustrating the steadiness of the drifting polar ice, and how even the most delicate investigations may be carried out there, I may mention that during the *Fram* expedition 1893–1896 my comrade Captain Scott-Hausen managed to make pendulum observations for determination of the gravity, on board the *Fram*, frozen fast in the drifting ice. These are the only pendulum observations ever made over a deep ocean. It may thus be understood that from this solid, drifting ice, even the most delicate measurements of the water movements at all depths can easily be carried out, if only the movements of the ice itself can be accurately determined, which is not difficult, as I have already pointed out.

The changes of the movements of the water at different depths can easily be followed through day and night and through the whole year, and year after year. By simultaneously studying the changes of temperature and salinity of the sea, at the different depths, we may attain such an intimate knowledge of the water-strata of the north polar basin and their movements as we cannot, even approximately, obtain in any other part of the ocean. And the knowledge thus acquired cannot fail to give us entirely new views of the dynamics of the ocean, and will carry physical oceanography an important step forward. In his oceanographical laboratory, built of snow on the north polar ice under the polar star, Amundsen may thus be able to find the solutions of the many difficult problems which all oceanographers are now waiting for.

I consider it unnecessary for me to say much about the practicability of Amundsen's plan to drift with the ice across the north polar basin. I think that this is fully proved by the first *Fram* Expedition, 1893–1896. And lately it has also been proved by the two American drift-casks placed on the ice, the one north-west of Point Barrow, Alaska, and the other near Cape Bathurst, in North-Western Canada. The former was, six years later, found on the north coast of Iceland, the latter was only a few weeks ago, after eight years, found on the coast of Northern Norway, just where we hope to see Amundsen again after *less* than eight years, and with his ship loaded with a unique material of scientific observations.

(2) Sir CLEMENTS MARKHAM: I welcome the resolution of my friend Amundsen to follow in the footsteps of Nansen, and continue the exploration of the polar ocean. His plan is well conceived, and its execution, even if only in part, will certainly be productive of very important scientific results. I am satisfied, after a study of the subject during many years, that the chances of success for a well-designed expedition on Amundsen's plan are good.

After the return of the last British naval expedition in 1876, the evidence was completed that there was heavy ice-pressure along the American side of the Arctic regions from Cape Barrow to the north-eastern end of Greenland, and that the only

channel of escape for this polar ice was down the east coast of Greenland. It appeared to me that this pointed to a polar ocean of great extent, and to a drift from the Asiatic to the American side. In my paper on the results of the Arctic expedition of 1876, published in our *Proceedings* in 1877, I held that there was a deep sea to the north of Franz Josef Land, and that most important work would be achieved by pushing northward from the Siberian coast. Many years afterwards Nansen, never having seen my paper, adopted the same view. There were prophets of evil among our experts, as doubtless there will be now. Naturally, I felt confident that his plan was the right one, and never doubted his success. That success threw a flood of light on the Arctic problem.

In order to achieve a drift across the polar ocean, by a route different from that of Nansen, it will be necessary for the *Fram* to follow the track of the *Jeannette* for some distance to the eastward, and Amundsen will use his judgment as to the opportunity to be taken for pushing northwards over the continental shelf and into the drifting ice. Whither he will be taken it is impossible to foresee with our very limited knowledge. It is sufficient that he will be taken into an unknown region of the deepest interest, and that he will be supplied with all the means of making valuable discoveries and researches. That it will be a very perilous undertaking cannot be disguised. But the guidance of a really capable man very largely reduces the danger. Like the enterprise of Nansen, it is a grand conception, worthy of the first navigator of the north-west passage.

(3) Admiral Sir Albert Markham: His scheme is, undoubtedly, a daring one, and for the special object which he hopes to achieve, namely an examination of the bottom of the Polar basin, it is, in my opinion, an excellent one, and is bound to produce important and valuable results. I see that he proposes to start in a northerly—or north-westerly—direction from Point Barrow, run his ship into the ice directly he meets it, and trust to the drift to carry his ship whither it will, as it did Nansen on his memorable voyage some fourteen years ago. From all accounts hitherto received of the ice in this neighbourhood, it appears to be of a formidable character, somewhat similar to the heavy impenetrable ice invariably found on the east coast of Greenland, and which we experienced in 1875-6 to the north of Robeson Channel—ice that it would be dangerous—nay madness—to force a ship into with the intention of allowing her to drift with it!

In my opinion it would be better, and lead to more successful results, if he was to follow more closely in the footsteps of Nansen—and he could not follow a better man—and run the *Fram* into the drifting pack further to the west, but east of the New Siberia islands. In this vicinity the drift of the ice to the north is more likely to be affected by the outflow of the large Siberian rivers, than it would be in the neighbourhood of Point Barrow. A reference to Nansen's track in the *Fram* shows that the drift of the ice, when he entered it to the north of the New Siberia islands, took him nearly due north for about 150 miles, then away to the N.W. until the latitude of 85° was reached, and thence to the west until the ship was finally liberated from the ice.

It is to more thoroughly explore this almost unknown basin, to ascertain its depth at various positions, to obtain observations regarding the temperature and salinity of its waters, and the direction of its currents, that the attention of those in the *Fram* will be especially directed. We wish them good luck and God speed in their brave efforts to carry this important enterprise to a successful conclusion. They go forth in a ship whose efficiency and capabilities have already been well tested, and led by a man who has already made his mark as a brave and energetic arctic explorer.

Admiral Sir Lewis Beaumont: The subject has been so entirely scientific, with

the exception of the last few remarks of Captain Amundsen, that it hardly comes within my province, which is more the navigator's part and the methods to be employed. I have, therefore, really very few words to say. But when it is remembered that the expedition contemplates being absent for such a very long period of time, possibly seven years, it seems as if it would be of great value, if in some way or other, possibly by wireless telegraphy, it was possible to establish communication with the expedition during the time of its absence. It has always been the custom for those who are responsible for Arctic exploration, to look forward to the time when it would be necessary to search for an expedition that was overdue; but if this expedition actually starts with the idea that it may be away for seven years, it is a very long time to wait before one can feel that it is overdue, and from that point of view it is not too much to expect that some such communication should be established with an absent expedition, in order that fears as to its welfare might be relieved. I make that as a suggestion which seems to me one to be considered in a case of this sort. Except for that, my only other remark would be that for such an expedition as this, a ship is absolutely necessary; not only for use as a ship but as a depôt, as a home, and as a starting-point if any accident or danger made it necessary for them to try to reach land; there is no other way in which such work could be done. As regards the actual going for seven years, I entirely sympathize with Captain Amundsen, whose object is to realize the full benefit of his project, and if it was possible to go back forty years, I would be glad to go with him.

Sir JOHN MURRAY: I listened with very great pleasure to this account of the second proposed drift of the *Fram* across the Polar basin, and I hope that the expedition will be carried out, and if so, I have no doubt it will result in large additions to oceanographical knowledge. It is now just about forty years since I spent a whole season in a Scottish whaler, cruising amongst the ice-floes between the coasts of Greenland and Spitsbergen. From observations made at that time, and from general considerations, I came to the conclusion that in the Polar regions there was a deep basin. When in 1887 I published a paper on the heights of the land and the depths of the ocean, I estimated the greatest depth of the Polar basin at about 1500 fathoms, and I estimated that there was an area of about two millions of square miles, with a depth exceeding 1000 fathoms. It may ultimately be found that this estimate is not very far from the truth. Nansen, however, as we have just been told by Captain Amundsen, believed that the Polar basin was a shallow sea, and consequently he did not fit out the *Fram* with a deep-sea sounding apparatus. Should the *Fram* on this occasion be fitted out as for a truly oceanic expedition, and the expedition be successfully carried out, most important observations will certainly be made.

The Polar basin must be regarded as a partially enclosed sea, but from the peculiar thermal conditions of the region it should be quite unlike the enclosed seas with which we are acquainted in southern latitudes. The Atlantic water which sinks to the bottom of the Polar seas carries with it an abundance of oxygen, and in this respect should be very favourable for the development of marine organisms in great depths. I therefore hope that this expedition will take with it trained biologists, who (if it be possible, as Captain Amundsen suggests, to dredge from the surface of the ice-floes) will be able not only to give an excellent account of the marine animals in the Polar basin, but to observe the rate of growth, of reproduction, and of assimilation, and generally the metabolism of organisms which live during the whole of their existence at a temperature below the freezing-point of fresh water. These observations could then be compared with similar observations on similar marine organisms, which, in the tropics, live all their lives in a temperature between 70° and 80° Fahr. Observations are much needed in this direction,

and it would be a pity to lose the opportunity of making them on the proposed expedition.

Dr. MILL: As a student of oceanography I should like to say that, in my opinion, the greatest result of the first voyage of the *Fram* was that it took out Dr. Nansen as a biologist and brought him back an oceanographer. He has devoted his life since then to the advancement of oceanography, to the improvement of the methods, and to the study of the results. As one of the representatives on the International Council for the Study of the Sea, it has been my good fortune to be associated very intimately with Dr. Nansen, with Prof. Pettersson, and with other continental oceanographers during the last eight years, and I have seen with amazement and delight the enormous advances that have been made in oceanographical apparatus of all kinds. I believe, even though I disagree with trembling from Sir John Murray, that they can read their new thermometers to $\frac{1}{100}$° C.

Sir JOHN MURRAY: They can read them, but what is the reading worth?

Dr. MILL: That is very largely a matter to be decided when the results of the various expeditions come home. I believe that very small differences of temperature will be found to be of real physical importance, and that they are capable of being measured with accuracy. The only fear I have for Captain Amundsen is that there may descend upon him the woe that threatens those of whom all men speak well. When Nansen first proposed his great drift across the Polar basin, the Arctic veterans besought him not to throw his life away on such a wild-goose chase, and those of you who were present then will remember how Nansen replied that he was going all the same, that he took a ticket with the ice, instead of struggling against it. The change of expert opinion now is indeed enormous, and in following Nansen's example I think Captain Amundsen is doing exactly the right thing, and it is surprising to the student of Polar exploration how comparatively seldom the experience of one successful expedition has been made use of by another. It is extraordinary how frequently the old errors have been repeated, and it is remarkable also how much greater has been the success of those expeditions that have gone out on the principle of Nansen when he crossed Greenland, of having no line of retreat, than of those expeditions which went out in the hope of relief expeditions being sent to them in case of need. I rather think more lives have been lost and more money wasted in relief expeditions, than on the expeditions which carried the explorers who set out to do the original work. For all those reasons I wish to express on my own part, and, so far as I may speak for the oceanographers of this country, on their part too, the heartiest wishes for the greatest success to Captain Amundsen, and the hope that he will return triumphant after drifting across the Polar basin in much less time than the generous allowance of seven years which he has provided for his labours.

The PRESIDENT: I do not myself intend to take any part in this discussion, not being an expert on Arctic affairs. But as one who is not an expert, I should like to thank Captain Amundsen sincerely for the extremely clear way in which he has placed these problems before us. It has been one of the most interesting lectures I have ever listened to on Arctic problems. I sincerely trust that the Society, of which I have the honour to be President, may be of some use to Captain Amundsen in his preparations, and I can assure you we shall do our utmost to help him. I have merely now to thank him, as I am certain I may, in your name, for his extremely interesting lecture, and also, though it is somewhat in advance, in the name of every one here present and in the name of the Society, wish him God-speed and good luck in the venturesome and plucky journey he is about to undertake.

Captain AMUNDSEN: As to the question of Admiral Sir Lewis Beaumont about wireless telegraphy, I must say that I have studied this important question

thoroughly. I have come to the conclusion that a wireless in many cases, perhaps, would be of immense value to us, and could render us good services; but nevertheless I have decided not to carry a wireless, and the reason is this. Imagine that we have spent two years in the drifting-pack, and still have three more years to spend—imagine that we suddenly get a despatch stating that some of our dears are seriously ill or dying, or whatever it may be. What would then be the result? Nobody can tell, but the worst might happen. That is the reason why I do not take any wireless appliances. And then with regard to obtaining an accuracy of $\frac{1}{100}$° C. I wish to tell you that I think I shall carry home those observations made to that degree of accuracy. As to the apparatus for the search of samples of the bottom, we have it, and I intend using it. I now beg to thank all the gentlemen who have honoured me by taking part in the discussion to-night. The speakers we have listened to, and the gentlemen who have been good enough to address letters to our meeting, represent together the greatest experts and the most profound knowledge of Arctic exploration. I have listened with the greatest interest to everything that has been said with regard to my proposed expedition, and I wish to express my heartfelt thanks for the very kind and valuable advice which has been given me, and for the very kind and sympathetic way in which you have received the plan for my new expedition.

GEOGRAPHICAL CONDITIONS AFFECTING THE BRITISH EMPIRE.

I. THE BRITISH ISLANDS.*

By H. J. MACKINDER.

It is proposed that there should be a series of papers before this Society dealing with the geographical conditions which affect the British Empire, and I have been asked to speak of these conditions as they affect a portion of the Empire, namely, the British Islands.

It seems to me that, in viewing the geographical circumstances of any nation, we must have regard chiefly to four points. First, there is the productivity of the country occupied, and in this we must include not merely fertility, but also the supply of mechanical power, whether it be from falling water, or from fossil fuel, or in the form of tidal currents available for traffic in the river estuaries. Then we cannot wholly omit, even from a discussion which is primarily geographical, some attempt to assess the man-power of the nation, which is the product of the number and the present quality of its people. It is probable, for instance, that the teeming millions of China do not, for lack of effective education, man for man, at present count in the balance of power against the men and women of western Europe, and therefore we are obliged to have recourse to a conception based on the product of number and quality. Thirdly, we have the position of the country to analyze relatively to the degree and modes of human mobility in the age under consideration. The value of a natural fortress alters, for example, as the range of weapons grows. Lastly, organization must be treated of, and here must be correlated social organization and the betterment of the land and

* Read at the Royal Geographical Society, March 30, 1908.

its adaptation to human purposes, for the organized people and the improved country are, as it were, the working parts and the bearings of a complicated machine. Even social organization proper has its geographical aspect. There are few things more difficult, for instance, than to change the habit of frequenting particular markets. In regard to all four of the points thus enumerated, we have, in addition, to keep in mind the fact that the problem is dynamic, or, in other words, that there is an element of historical momentum to be compounded with the direct action of the physical and human environment. In an old country such as Britain this factor of momentum becomes so important that the discussion must belong in no small measure to the realm of historical geography.

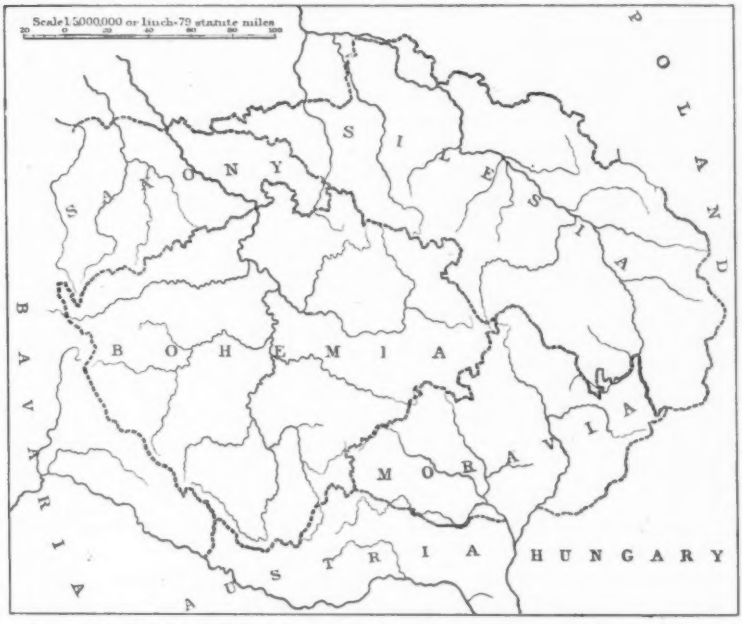
It is not my intention formally to divide my material into sections corresponding to these theoretical ideas, but I would ask that they should be borne in mind, because what I have to say will be based on the assumption that they are accepted.

To understand the geographical conditions which have affected British history, and which therefore affect the British position of to-day, it is necessary next to take into account some aspects of the geography of Europe at large.

The evolution of Western civilization has taken place under conditions which usually limited human mobility in Europe to what may be described as the Narrow Waterways. Except for the interlude of several centuries when the Roman road system was effective, movement upon the land has been relatively difficult, until lately, in this part of the world. In a paper which I had the honour of reading before this Society not very long ago, I referred to the geographical pivot of history as being that great heart of the old world of Euro-Asia, in which nomadic men rode on horseback over the treeless steppes, or across the desert on camel-back. In Europe there were continuous forests and marshes, which impeded even the movement of horses and still more that of wheeled vehicles. On the other hand, oceanic voyages were not undertaken until the time of Columbus. For a thousand years, therefore, European traffic was chiefly by boat, either coastwise or riverwise. The water offered a permanent way, with neither construction nor maintenance charges, and with low haulage charges. In that period the cities of Europe were founded upon river-banks, often at the confluence of tributaries, or at the head of the tideway, and the most natural territorial units roughly coincided with river-basins, their frontiers being approximately at the water-partings. Witness, for instance, such a group of territories in the heart of Europe as Silesia, Bohemia, and Moravia, or, in England, the counties of Yorkshire and Leicestershire.

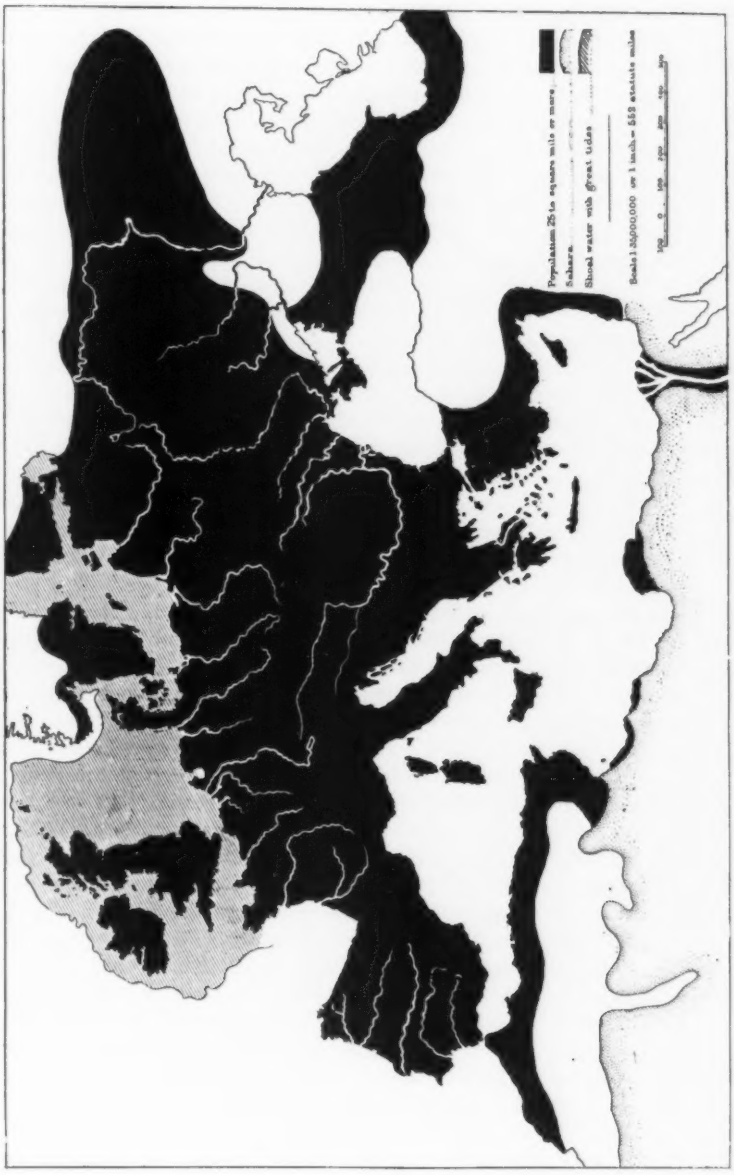
From this point of view, the most important feature of Europe is the parting of the coastways in the neighbourhood of Cape St. Vincent.

Thence one way leads eastward for 2000 miles to the Levant, and another north-eastward for 2000 miles to the North Cape, while a third way extends southward along the coast of Africa. The way southward along the African coast was, however, closed until the time of Henry the Navigator by the fact that the trade winds rendered the return voyage hazardous for ships which could not sail near to the wind, or trust themselves across the wind away from the known coastway. It is curious that ships should not have been built to sail really near to the wind until after the advent of steam vessels.



Part of CENTRAL EUROPE, showing approximate coincidence of Political Units and River Basins

At first sight it would appear that the coastways which part eastward and north-eastward from Cape St. Vincent differ essentially by reason of the enclosed character of the Mediterranean as contrasted with the open oceanic coast. But it must be borne in mind that to the south of the Mediterranean is the Sahara, the true boundary of Europe, dividing the white man from the black man, and that Barbary is in consequence for practical purposes insular. On the other hand, the way along the oceanic coast ends where the Polar ice closes in to the shore, and either prohibits or endangers navigation. Thus Europe


Population 25 to square mile or more.
Sahara.
Shoal water with great tides
Scale 1:35000000 or 1 inch = 553 statute miles
0 100 200 300 400 500

EUROPE SHOWING THE NORTHERN SERIES OF RIVERS, AND THE SOUTH EASTERN GROUP OF RIVERS.

lies between two blind coastways, with the coasts of Britain and South Scandinavia detached but accessible on the one hand, and those of Barbary and Asia Minor detached but accessible on the other. To-day the area of dense European population may be considered to end in the great bend of the Volga near Kazan, and along the lower course of the Don from the second bend of the Volga at Tsaritzyn. The Volga itself offers an important, though until lately detached, waterway along the border of the true Europe from the neighbourhood of St. Petersburg to that of the Sea of Azof. St. Petersburg is to-day a great port largely by virtue of its canal communications with the Volga.

In addition to the coastways we have to consider the riverways, and between Cape St. Vincent and the Volga the riverways of Europe form two groups. On the one hand there is a bunch of great rivers—the Don, with the Donetz; the Dnieper, with the Bug; the Dniester; and the Danube, with the Pruth—which gather to neighbouring mouths in the Sea of Azof and the Bay of Odessa. On the other hand there is a long series of rivers—Neva, Duna, Memel, Vistula, Oder, Elbe, Weser, Rhine (with Moselle und Meuse), Seine, Loire, Garonne, Douro, Tagus, Guadiana, and Guadalquivir—which flow north-westward or westward to the oceanic coast. The remaining rivers of the Mediterranean are unimportant for purposes of navigation, however communication by land may have been facilitated by the existence of their valleys.

We are concerned here chiefly with the series of the oceanic rivers, and these we may subdivide into three groups, a subdivision which is natural, for it depends on several criteria. In the first place we may detach the Baltic rivers, flowing through plains, and, therefore, for the most part navigable, but with waters gripped by winter frost during periods which increase eastward from one month to six months. Moreover, the Baltic is practically tideless, and these rivers are therefore devoid of estuaries. At the other end of the series are the four Spanish rivers, flowing in valleys for the most part deeply but incompletely trenched into a plateau, and owing to summer drought only intermittently supplied with adequate water. The abysmal ocean comes close to the Portuguese and Spanish coasts, and the tides are therefore relatively small.

Between the Baltic and the Spanish rivers, opposite to Britain, there remain half a dozen great streams which have facilitated civilization to an extraordinary degree. From the head of the Bay of Biscay to the entry of the North sea a vast shoal stands out from the coast of Europe which bears the British islands. The submerged edge of the continent follows a line from the Franco-Spanish frontier, midway through the Bay of Biscay, and then northward and north-eastward to the salient of the Norwegian coast north of Bergen, in such manner as to leave a considerable breadth of shallow sea west of Ireland and north of Scotland. One result of the existence of this British shoal is the

exaggeration of the tides along the coasts, both continental and insular, of the English and Irish channels and of the North sea, and as a further result the French, German, and English rivers have considerable estuaries, so that alternating currents are available to carry the shipping far inland, a fact of considerable significance when ships were moved by sails and oars, when there were Norse pirates on the water, and when the roads upon the land were no more than tracks beaten by the traffic. Even the mere torrents and creeks of Britain obtain importance owing to their estuaries. The wide bends, with a half-mile radius, of the lower Thames are to be correlated with the entering tides, not with the slender stream from the Cotswolds.

The shoal bottom of the English Channel, and of the nameless arm of the North sea which receives the Thames and the Rhine, is continued on either hand by low-lying plains in England and on the Continent. These plains end on the one hand in the hills of Central Europe and in the Alps, and on the other, in the mountains along the oceanic fringe of Britain. Thus the lower courses of the rivers are over easy gradients. The climate of the region is characterized, moreover, neither by the winter cold of the east nor by the summer drought of the south, and the flow of the rivers is, therefore, relatively steady and adequate. Thus we realize that Britain, studied physically, is rather coherent with the continent than a separate entity. Picture a great plain, low-lying, fertile, free from long winter frost, free from long summer drought, agricultural, densely populated, and traversed by slow navigable rivers which are entered by the tides. A shallow channel, tide-swept, extends through the centre of that plain, so that one section of it, the plain of southern England, is superficially detached from the remainder, namely, the plain of Northern France, the Netherlands, and North Germany. But in all its parts it presents the same characteristics and conditions for the development of human societies, saving only the insularity of Britain. Within this single and coherent natural region are clustered London, Paris, Berlin (with its outport, Hamburg), and that great capital of the Rhineland, which, owing to historical and physical circumstances, has been dissipated among competing towns—Amsterdam, Rotterdam, Ghent, Brussels, Antwerp, Liege, and Cologne. It is a region which in its combination of advantages is almost unique in the world.

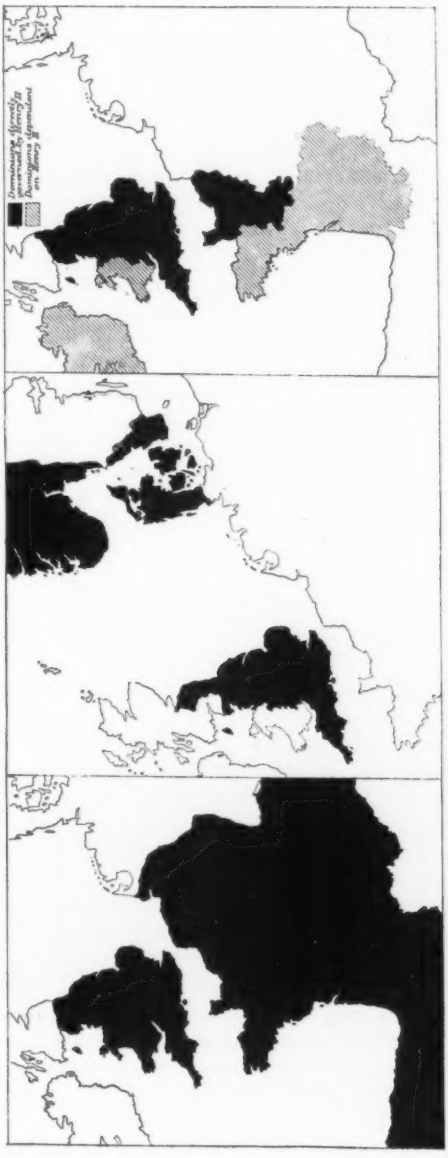
The insularity of Britain, and the political consequences of that fact, are trite themes, but it appears to me that the partnership of Britain in Europe is, to say the least of it, a no less significant fact.* Except when there has been adequate man-power, adequately organized, in the English plain, the people of that plain have not been independent of

* Since this paper was read, Mr. H. A. L. Fisher has discussed the insularity of the British nation before the Historical Association, using the European literatures as evidence, and has arrived at a conclusion parallel to mine as here stated.

the peoples of the greater plains on the other side of the Channel. For four hundred years Rome ruled in South Britain. Then for six hundred years South Britain was in frequent relation with the plains, Saxon and Danish, on either hand of the Elbe. Finally, in the fateful year 1066, the eastward relations were broken at Stamford bridge, and the southward relations resumed at Hastings. Not until the Tudor epoch did the Channel become an effective boundary, and during all the previous ages the frontiers within Britain, between plain and highlands, and between island and island, were effective to the extent that London was more closely connected on the tideways with Paris, Flanders, and the Hanseatic cities than with Scotland or Ireland or Wales. Shakespeare was entitled to speak of the "moat defensive," but not, in any complete sense, his ancestors.

The features of the mainland opposite to Britain are therefore an important part of the environment which has conditioned the development of England. They are important, I think, chiefly in two aspects, as they have enabled the continental peoples to influence England, and as they have on the other hand enabled the English people to influence the continent. In the first regard, we have to notice the remarkable convergence towards Britain of the valley-ways across the European peninsula from the southern coasts to the northern. Enclosed, in the days before Columbus, northward by the Polar cold, westward by the oceanic vacancy, and southward by the Saharan drought, Europe received external stimulus, whether of trade, conquest, or religious propaganda, only from the south-east, the direction of the Indies. The tracks of invasion, whether peaceful or warlike, material or spiritual, once within Europe, may be regarded as four in number. First, there were the water-ways, with short connecting landways, which led from the Black sea, outside the bastion of the Carpathian mountains, north-westward to the Baltic, or down the Oder and Elbe to Hamburg, at the re-entering angle of the oceanic tidal coast. Secondly, there were the ways either by the Danube or the Adriatic to the Rhine. Thirdly, there was the way, perhaps most important of all, from the Gulf of the Lion, which enters between the Alps and the Pyrenees and emerges either on the Rhine or the Seine. And fourthly, there were the ways by Gibraltar, either through the North of Africa and through Spain into Gaul on the track of the Saracens, or through the length of the Mediterranean and round the Oceanic coasts. All four of these groups of ways converged upon South Britain, which thus stood at the end of the civilized world, and was yet richly supplied with stimulus from that world.

On the other hand, we have to consider the influence which the English people could bring to bear on the continent. In this connection it is important to note that the salient angle of Britain, formed by the south and the east coasts where they intersect at Dover within sight

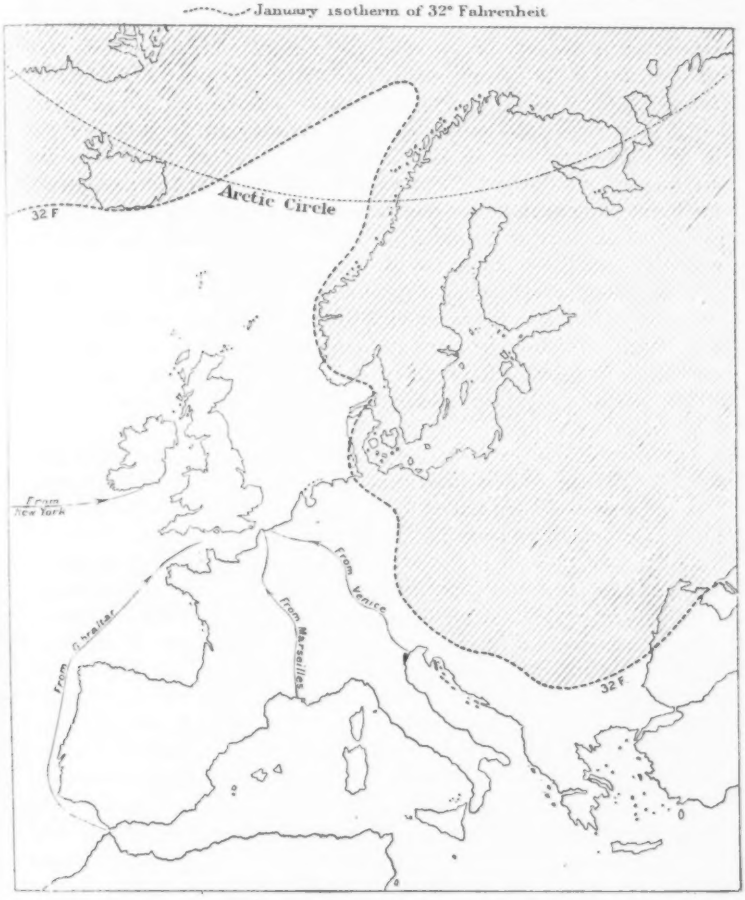

ROMAN TERRITORY
on both sides of Channel, but not throughout Britain
DANISH TERRITORY
(temp. Canute) on both sides of North Sea but not throughout Britain
ENGLISH TERRITORY
(temp. Henry II) on both sides of Channel, but not throughout Britain
Dominions of Henry II. governed by Henry himself
Dominions of Henry II. governed by Henry's feudatories
Scale 1 250000 or 1 inch = 394 statute miles

of the continent, is placed almost exactly opposite the end of the linguistic frontier which divides the Romance peoples of Gaul and the Western Mediterranean from the Teutonic peoples of Germany and Scandinavia. Approximately, although not exactly, another line, a little eastward, has divided since the time of the Reformation the Catholic from the Protestant world. Owing to the gap between the Pyrenees and the Alps, France has from Roman times adhered rather to the Mediterranean than to the Baltic system of nations. Thus the coasts most nearly opposite to Britain have never from Roman times downward presented a united power, except for the short interludes of the Carolingian and Napoleonic empires. Had the Roman frontier been carried forward in the days of Augustus from the Rhine to the Elbe or the Vistula, and had Germany been latinized as was Gaul, it is improbable that the Plain of South Britain could have been made the basis of a nation independent of the continent. The traditional policy of England in the last few centuries has been to maintain the balance of European power, and so to prevent Europe, and especially the coast-lands opposite, from being united under any single military despotism. This, it seems to me, has been rendered possible in part, no doubt, by the British insular position, but no less by the Mediterranean influences which have entered Gaul through the gap between the Pyrenees and the Alps.

Prior to the days of Columbus, the relations of Britain to the outer world were mainly through its south-eastern quadrant. North-eastward and south-westward, towards Scandinavia and towards Spain, there were minor relations, while to the north-west was the boundless ocean. The effect of the discoveries of the age of Columbus was, of course, to give to the south-west quadrant of Britain a significance equal to that of the south-east, but of a very different character. It is important to realize that the ocean ways approach Britain convergently in a bundle from the west and south no less distinctly than the land ways approach in a similar convergent bundle from the south-east. The mouth of the St. Lawrence lies several degrees south of the mouth of the Channel, and Cape St. Vincent several degrees west of the same point. Indeed, Britain may be regarded as lying in a unique north-eastward bay of oceanic traffic, enclosed by the shore of the great continent and by the ice whose edge extends southward from Iceland to Newfoundland. The man in the moon, looking at our continent during the winter, would see, white in the sunshine, a great sheet of snow, covering Russia, Sweden, Norway, most of Denmark, half of Germany, nearly all of Austria and Hungary, and the region southward to the Balkans, and he would see, perhaps reflecting the sunlight with a more subdued sheen, the great belt of floe-ice east of Greenland which extends southward to the latitude of the English channel. Britain is thus in the centre of a northward bay of winter warmth and resulting fertility,

with the frozen land to the right hand, and the floe-barrier to the left hand. The text-books often speak of the advantage obtained by this country from the fact that it lies in the centre of the land hemisphere. But I think that a truer conception would regard it as lying at the end

POSITION OF BRITISH ISLES IN GULF OF WINTER WARMTH



of the land-ways in the Pre-Columbian times, and at the end of the oceanic ways in the Post-Columbian times.* In both cases, it is for

* In the discussion which followed the paper, Mr. Chisholm criticized my statement on this point. It will be seen that my contention amounts to this—that while

effective purposes at the end, and not in the centre, of the world. Strategically, this has been its great strength, whatever may have been, or in future may be, the economic loss. The whole defensive strength of the nation has been concentrated on relatively narrow fronts, south-eastward towards the continent on the one hand, and south-westward towards the ocean on the other.

May we not visualize one aspect, at any rate, of British history, especially in the late Stuart and early Georgian times, somewhat in this way? By the oceanic roads from the south-west—from the East Indies by the Cape of Good Hope, and from North America—Britain received strength which she spent south-eastward in subsidies and in war-like operations in her traditional policy of preventing the despotic union of Europe. The conquest of Canada and the support of Frederick the Great in the Seven Years' War were thus the natural consequences of the geographical position of Britain, of the free approach from the ocean on the one hand, and on the other of the need of maintaining the balance of power in the neighbouring coastland of Europe. The two fronts which Britain presented to the world were utilized to receive power and to spend power, with the object of preventing the establishment of a united European Empire, against which no power organized merely on the productivity of these islands could hope to stand.

A century ago there came the Industrial Revolution, essentially dependent on the utilization of coal as a source of mechanical power. The peoples on either hand of the Channel, leading from the Atlantic to London and Hamburg, now received a fresh impetus. Favoured beforehand for trade by the tides on the British shoal, and for tillage by the climate of the lowland plains, free from the winter frosts of the east and the summer droughts of the south, they now added to Agriculture and Commerce great modern Industries. The coal of Europe lies chiefly in Great Britain from the Highlands southward, in Belgium and the lower Rhineland, in Saxony, Silesia and Bohemia, and in Southern Russia. There are thus naturally four great industrial nuclei forming a chain across Europe, and three of these nuclei are accessible by waterways from the Channel and the North sea, and by roads and railways with easy gradients on the plains. The industries of Britain rose first, and those of the continent were delayed, partly because Britain had cheap capital available from her oceanic commerce, and partly because she supported wars on the continent, making, no doubt, ultimately for freedom by preventing a widespread despotism, but none the less delaying the development of industrial competitors.

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the productive plains on the south-east side of the narrow seas share with the English plain the equable climate, tidal waterways, and terminal position on the land and ocean roads, they do not, for lack of insularity, share all the strategical advantages incidental to those geographical characteristics.

THE MARITIME LOW LANDS OF NORTHERN EUROPE

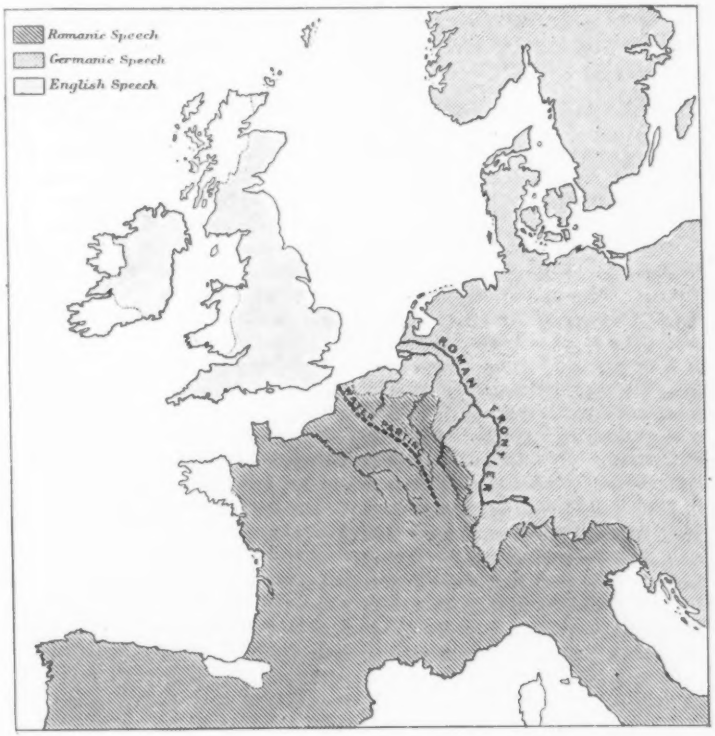
The tidal Seas and Estuaries, and the principal coal fields

Since 1878 the essential similarity of the regions on either side of the Channel and of the North sea has again become evident in the industrial rivalries of Britain, Belgium, and Germany. From the time of the Treaty of Berlin the world has entered on a new phase, both politically and economically. The decisive wars of the preceding generation in Europe, North America, and India put an end to the earlier epoch. The pre-eminent characteristic, I take it, of our own time is the marvellous development of human mobility. In 1870 only 10 per cent. of the world's shipping was moved by steam. To-day only 10 per cent. is moved by wind. Moreover, trans-continental railways are competing with oceanic traffic, and cables, wireless telegraphy, and telephones have given a fresh mobility to ideas. Whether we like it or not, we have come to the time of great empires, and of commercial and industrial trusts. It may be that a generation hence the economic centre of the British Empire will necessarily cross the Atlantic to Canada, because there will be the greatest seat of natural productivity and of man power. It is to be hoped that it will do so, for in this little island we have not productivity sufficient to base an empire which shall hold its own with the great continental empires that are developing. But if the organization of the Empire has progressed both on its material and spiritual sides sufficiently to maintain a united force as a counterpoise to the developing power of the great continental empires, then the British isles will retain much of their old importance, as being the advanced position for the defence of Canada and the other dominions beyond the ocean. As far as we can see, the offensive-defensive policy of the empire, whether military or diplomatic, must rest on a maintenance of the balance of power in Europe, and for this purpose Britain will be essential as a naval base, although with the gradual increase of Canadian resources it will come ultimately, no doubt, to have some of the characteristics of the flying base of naval strategists. When Britain destroyed the Armada or blockaded Brest from Devonport, her shores were being utilized to exert pressure on European policy, precisely as they will be utilized under new conditions at the ports of Chatham and Rosyth. It must long remain of interest to Canada and the United States of America that a fleet should not ride the ocean based on the productivity and the man power of a united continental Europe.* To prevent this a European flotilla and a near convenient base will be essential to them. After all, the building of a fleet is largely a matter of money, and money is but the index of effective productivity. The question is not one of party politics, but of political and geographical philosophy.

* In the discussion which followed the paper, Mr. Chisholm cited the Monroe doctrine as invalidating this conclusion. I do not admit, nor do I believe that far-seeing Canadians admit, the sufficiency of the Monroe doctrine. But in any case it will be seen that my statement includes the United States, and therefore includes the case put by Mr. Chisholm.

In these ideas no doubt a far reach of imagination is involved, removed from the world of the present generation and of practical policies. I venture to think, however, that the value of Britain off the coast of Europe as a defence for Canada and the east of the Empire, under not impossible conditions a generation hence, is an idea to which the geographer may well call immediate attention. The prospective

The advance of Germanic speech from the Roman frontier towards the Seine–Rhine Divide



Scale 1·20,000,000 or 1 inch-315 statute miles

worth of the British Empire to its younger and remoter nations is under consideration. We live in the days when a battle fleet can circumnavigate the globe, and wireless telegraphy can span the Atlantic. There have been those in the not remote past in responsible positions who were ready to consider the surrender of Britain's naval bases in the Mediterranean. It is still a moot question whether the surrender of Heligoland was not a mistake. The younger nations of the British

Empire are just now daily considering and weighing the value to them of the imperial bond. It is the function of the geographer to point out the value of an island placed off a continent. While Europe remains the chief seat of national rivalries, this island may still have to remain the chief depository of imperial power, even though the main sources of that power be over the broad ocean. Germany looked forward a generation when Bismarck and Von Roon forged that weapon, the German army, which made the German power of to-day. Bismarck looked forward a generation also when he annexed the territory through which the Kiel canal was to be constructed. In these matters, and in these days, foresight of a generation's length is not excessive where the vital questions of territorial productivity, national man power, strategical position, and imperial organization are under consideration.

Mr. CHISHOLM: I have to express my thanks to Mr. Mackinder for the stirring and stimulating address to which we have just listened. It is an address eminently fitted to excite thought, but Mr. Mackinder, I am sure, will not be surprised if it excites reactive thought, and some of the remarks that I have to make upon the paper will be of the nature that I have indicated. Mr. Mackinder laid stress upon the fact that in the study of the geographical conditions of any country, an important place—indeed, the first place—was to be assigned to the productivity of that country, and there I am entirely at one with him; but it seemed to me, in reading this paper, that this consideration was not sufficiently borne in mind by him. In a latter portion of the address he spoke of four groups of ways which, in pre-Columbian times, converged upon Britain. The suggestion was, or at least appeared to be, that Britain was from the first the final goal of those ways, and that Britain, more particularly South Britain, derived a special degree of importance from that circumstance. Now, I think that that represents a misconception. I can hardly imagine, indeed, that that conception was in the mind of Mr. Mackinder. What we have to take into account in explaining the degree in which all those groups did converge upon Britain, was the productiveness of Britain itself, and, coming down to more recent times, it seems to me that regard to the productiveness of our own times is absolutely necessary in order to justify the contention of Mr. Mackinder that in these times Britain is at the end of the ocean ways. If we look merely at the relations which we may see upon a globe, one would think that that is rather a fantastic description, and yet it must be admitted that nowadays the streams of commerce that make for our own islands thicken as they approach them, but the explanation is to be found in the remarkable productiveness direct and indirect of the islands themselves. If we look merely at the relations of sea and land as represented on a globe, I should think it is rather the opposite shores of the North sea than our own islands that might be described as lying "at the end of the ocean ways," and I suppose that was the thought that was present in Mr. Mackinder's mind when he referred in one passage to the economic loss that may have resulted in the past, or may ensue in the future, from the insular position of Great Britain. In one part near the conclusion of this paper, the consideration of productiveness was certainly prominent in Mr. Mackinder's mind, namely, in that passage where he refers to that period, say, a generation hence, when it may be anticipated that Canada will be much more productive than our own island. If it is safe to make any forecast with regard to the distant future at all, I should think that that forecast is one of the safest; but at the same time

I can hardly follow Mr. Mackinder in one of the conclusions which he deduces as to the part which is then to be played by the British Islands as a sort of naval outpost for the defence of Canada. In a subsequent reference which he makes to North America as one of the islands which in the future will have the function of maintaining the liberties of the world, one may surely see a sub-consciousness of the fact that in North America there is a Monroe doctrine which, if there were any danger of attack on Canada from the other side of the Atlantic or other side of the Pacific, would come into play in relation to Canada itself as well as other parts of America. But in any case, whatever be the function of these islands in the future of the British Empire, the productiveness of the islands themselves must remain a vital consideration for their inhabitants. In these remarks I have ventured to dissent more than once from the conclusions that Mr. Mackinder has arrived at, but at the same time I do not want to sit down without expressing my concurrence with at least one portion of the attitude that has been adopted by Mr. Mackinder—with his attempt, namely, to forecast the future, and even perhaps sometime distant future, upon the basis of geographical data. It is quite true that no one can forecast the future with success. The absolute uncertainties of the future are in many cases quite incalculable; but altogether apart from that, even the various considerations that we may have the means of taking into account cannot possibly be comprehended by one mind, and there is an advantage in having the suggestions of one to be compared with and, if necessary, revised in the light of considerations brought forward by others. I would therefore repeat my thanks for this stimulating address, and add this—that I feel sure that when he next addresses this Society, if I have the opportunity of being present, I shall look forward with confidence to hearing an equally stimulating address on that occasion.

The PRESIDENT: Before proposing a vote of thanks to Mr. Mackinder for his inspiring address, I will say a few words, not, however, by way of a general review, because I agree with the last speaker that it is extremely difficult to deal briefly with the whole of a paper which rises to such a height. I think it is better suited for home study than for discussion here to-night.

The first point I will deal with is the factor of productivity, in which the lecturer included mechanical power. One of my fears for the future has long been —there may be nothing in it—that the power of the future will remain (for some time, at least) with the countries which have exceptional water-power. Sooner or later our coal-supply will be exhausted; but, long before that time, the waterfalls and rivers of the world will, through electricity, have their day, and countries fortunate enough to possess mountain ranges, or great rivers like the Zambesi or the Nile or the Amazon, will be able to obtain electricity cheaply. When that day comes, Great Britain will have to rely upon Mr. Mackinder's second factor—man-power. I believe that man-power has been the real secret of the success of this island in the past, and may sustain it for generations to come. Speaking of man-power, Mr. Mackinder took China for his antithesis, and I think he pointed out that, man for man and woman for woman, the Chinese are an inferior race. I wish he had taken some other example, as, if there is one country in the world where man-power can match ours when it is properly organized, that country is China. I believe that the man-power of China, quite apart from mere numbers, is equal to that of any other country, and possibly superior even to our own. I pass on to Mr. Mackinder's remaining factors, in which I hope Britain may take a lead, but I am very doubtful. They are capacity of organization and forethought. If we are not to disappear as a nation, we must learn to be an organizing race, such as the Germans or the Americans; we must also acquire the habit of forethought, and I do not think we could learn this better than from the Jews. I am sure you will join in a cordial vote of thanks to Mr. Mackinder.

Mr. MACKINDER: I owe a debt to the two gentlemen who have been good enough to speak, for having brought out certain points as to which I had apparently not made my meaning clear. It is always difficult, when called upon to consider and to express large ideas in a short time, to insert all the necessary limitations and qualifications. I need only say a very few words to make it evident that the speakers and I were in reality very much at one. I fully realize we owe much to the productivity of these islands, and that our man-power has been developed partly, at any rate, as a result of that productivity. My point, however, was that, owing to our position relatively to oceanic and continental ways, we have been able to add the productivity of other regions to that of our own, and have brought the resulting power to bear upon the European situation. Even in regard to the power of these islands, we must remember that organization is involved as well as productivity. Any one who motors through the rich plains of France or through the industrial districts of Germany can appreciate that their productivity is no less in quality and greater in extent than that of Britain. In no small degree the early utilization of the British productivity was due to the genius of William the Conqueror. It was he, the child of a coasting race, who made it safe to keep sheep in this country when barons were robbers elsewhere. I believe that strategical position and accessibility have accounted for British power no less than the productivity of the small plain of South Britain.

In regard to the other point raised, I may say that I think our position at the end of the land ways from the south-east and at the end of the ocean ways from the south-west is of real importance, for it has secured our rear from serious attack, except in the time of the Norsemen, and has enabled us to organize defence on a narrow front, and therefore with economy of man-power.

THE NEW BRITISH-PROTECTED MALAY STATES: KELANTAN, TRENGGANU, AND KEDA.

AMONG other results, the new treaty between Great Britain and Siam providing for the transference to British protection of the Malay states of Kelantan, Trengganu, and Keda will, it may be hoped, serve a useful geographical purpose in facilitating the opening up to knowledge of some of the least-known parts of the Malay peninsula. At present Kelantan, Trengganu, and Keda may be distinguished by the varying degrees of our ignorance concerning them. The best known is Kelantan, which lies to the north of Pahang and east of Perak, and which fronts on the China sea. For the past six years the Rajah of Kelantan has had at his court, as the representative of the King of Siam, a resident commissioner and adviser, Mr. W. A. Graham, through whose tactful diplomacy much has been done to check abuses and reform the administration. In a small handbook of information published last year, Mr. Graham gave a useful summary account of all that is at present known of the state. According to his estimates, Kelantan has a coast-line of 60 miles, a total land frontier of about 360 miles, a greatest length from north to south of 115 miles, a greatest breadth from east to west of 60 miles, and an area of 5500 square miles. About a fifth of this area is formed by a fertile plain which extends behind the coast for a distance of from 15 to 25 miles. Behind this plain the country gradually rises into jungle-clad mountains, which reach

their culminating point in Gunong Tahan on the borders of Pahang. In recent years Gunong Tahan has been ascended by three European parties, whose observations go to show that its elevation is rather more than 8000 feet. No geological examination of Kelantan has ever been undertaken, but Mr. Graham states that the highest mountains are largely composed of granite, while limestone formations also occur in places.

The chief rivers are the Kelantan, whose basin comprises nearly

the whole of the state, the Golok, and the Semarak, the last two flowing into the sea north and south respectively of the Kelantan. The Kelantan river has a length of about 120 miles, and at Kota Bharu, 8 miles from the mouth, is 400 yards broad. It is navigable by shallow-draught launches and big country boats for a distance of about 80 miles from the sea. For the first 20 miles of its course it is known as the Betis, then as the Ninggiri, then as the Galas, and finally as the Kelantan. From source to mouth the principal tributaries which it receives on the

right bank are the Galas, Lebir, Nal, Krah, and Bagan, and on the left bank the Sitong, Pergau, and Kusial. In its upper reaches the Kelantan river and its tributaries flow through mountainous, densely wooded country, and are obstructed by numerous waterfalls and rapids. A sand-bar off the mouth of the river prevents sea-going vessels from entering the harbour except at times of great floods, when a deep channel is scoured through the bar. The Golok river rises in the state of Legeh, in the Monton or administrative division of Patani, and after crossing the Kelantan frontier, crosses the coastal plain in a winding course about 15 miles long. The Semerak rises in the mountains on the borders of Trengganu, and flows to the sea roughly parallel to the frontier.

The climate of Kelantan is described as mild and equable, the heat being tempered by the land and sea breezes which blow morning and afternoon with great regularity throughout the greater part of the year. In the coastal plain Mr. Graham states that the temperature varies between 69° and 93° Fahr. In the hill country the range is slightly greater—from 62° to 96°. October, November, and December are the months of heaviest rain, the dry season covering the months of February, March, and April. In 1905, 98·43 inches were recorded in the plains, and 90·5 inches among the hills. In 1906, 108·34 inches were recorded in the plains, and 113·34 inches during eleven months in the hill country.

In the absence of any census no accurate return of the population is possible. Estimates have varied between 100,000 (Pallegoix) and 600,000 (Swettenham). From recent poll-tax returns the number of adult males appears to be close upon 60,000. If it be assumed that there are as many adult females and three times as many children, the total population works out at 300,000. This estimate Mr. Graham considers to be under rather than above the true figure, and in addition there are about 10,000 Sakeis and Jakuns inhabiting the wild mountainous regions of the interior. The Chinese population of Kelantan numbers about 8000 and is rapidly increasing, many Singapore Chinese having entered the state in recent years, either as shopkeepers or as coolie labourers. A certain number of Arabs reside in Kota Bharu, and there is a floating population of about forty Europeans employed in the Government service, and in various mining and planting enterprises. Kota Bharu, the capital and the only town of any consequence in Kelantan, has a population of about 10,000. The town is well provided with metalled roads, and evidence of increased prosperity and improved administration is afforded by the erection within the last three years of over one hundred and fifty substantial houses, mostly for use as shops. The roads have not yet extended any considerable distance into the interior, but there is telegraphic communication between Kota Bharu and both Bangkok and Penang, while the capital can also boast of a telephone service. The principal streets are provided with paved side walks, and are lighted by lamps at night. The other chief centres of

population are Tunpat (4000), Tabar (3000), Pacho (2000), and Semarak (500), all on the coast; Pasir Putteh (1000), near the Trengganu border, and Wachap Nau (1000), 7 miles west of Kota Bharu.

The prevailing religion is Shaffi Mohammedanism, which is still strongly impregnated with the animistic worship which formally constituted the religion of the people. The state is divided into two hundred and fifty mukim, or parishes, each of which has its own Imam (vicar) and Toh Bilal (curate).

Though Kelantan is primarily an agricultural country, Mr. Graham estimates that not more than 450,000 acres are under cultivation in the whole state. The chief product is rice, of which about 70,000 tons are produced annually. Coconuts are also an important product, every village being surrounded by plantations of the coconut palm. There are about half a million trees actually bearing in the state, while quite as many again have been planted within the last few years. The betel-nut is also largely grown and exported, and the cultivation of rubber has lately received a good deal of attention among the Malay land-owners, while other leading products are sugar-cane, maize, beans, pumpkins, melons, and various other fruits and vegetables. There is much land in Kelantan well adapted for grazing purposes, and the state is rich in live stock. Though no census of stock has yet been attempted, Mr. Graham estimates that there are probably some 20,000 buffaloes in the state, and 90,000 head of cattle (special attention being paid to the breeding of bulls for bull-fighting). There are also a large number of sheep and goats, Kelantan, Patani, and Trengganu being the only states in the Malay peninsula where sheep are found.

A large part of Kelantan is covered with forests, it being estimated that in the south there are over 3000 square miles of forest lands comprising many useful kinds of timber. In the jungles farther north the changal tree is found, this being the most important timber tree found in the peninsula. It is close-grained, easy to work, and impervious to the attacks of white ants. The jungle is also rich in products such as wild rubber and gutta-percha, resin, rattan, and bamboo.

The mineral resources of the state are both varied and extensive, though latterly Kelantan has been producing less mineral wealth than any other state in the peninsula. Gold has been mined from a remote period, though the industry appears always to have been in the hands of the Chinese. There is every reason to believe that tin exists in large quantities, and deposits of galena have been found, though their successful working is dependent on the improvement of communications. Some years ago the Rajah granted mining concessions with a lavish hand, but since the reform of the administration the Government has regained control over the mineral wealth of the country, and is seeking to promote its exploitation on sound lines.

Apart from agriculture the native industries are silk-weaving, boat-

building, fishing and the curing of fish, copra-drying, and brick-making. Formerly the workers in gold and silver enjoyed a considerable reputation, but their art has declined, and the modern craftsmen are only capable of turning out work of an inferior quality. With the development of good government, industry and commerce have taken on a very considerable growth, and in the Mohammedan year 1324 (ending February 6, 1907) the exports were valued at $1,153,948, and the imports at $1,388,435, the chief exports being copra, gold, betel-nut, paddi and rice, cattle, and dried fish; and the chief imports, cotton goods, specie, general provisions, kerosene oil, and timber.

Though a fair idea may thus be obtained of the general character of Kelantan, exact geographical information is almost entirely lacking, and the same remark applies with still greater force to Trengganu. The main source of information about the latter state is still the paper which Mr. Hugh Clifford read before the Society in 1896, embodying data which he collected in the course of an official expedition in 1895 (see *Journal*, vol. 9, p. 1). We are also indebted for some facts of recent information about Trengganu to Mr. R. W. Duff.

As in Kelantan, Trengganu possesses a fertile plain backed by ranges of wild jungle-clad mountains. The state, with an area estimated at 4500 square miles, embraces the basins of twelve distinct rivers, chief among which is the Trengganu river. Above the Kelemang falls this stream is mainly formed by the confluence of the Kerbat and Trengganu Ulu, which unite at Kuala Trengganu Ulu (not to be confused with Kuala Trengganu, the capital, at the mouth of the river). The Kelemang falls, which constitute a formidable barrier to all river traffic between the lower portion of Trengganu and the interior of the state, consist of a flight of eight rapids or cataracts extending over a distance of 3 miles. The rocky nature of the basin of the river continues for another 3 miles, and in the whole 6 miles the river drops perhaps 80 to 100 feet. The lower river flows through a fertile and thickly populated valley to the sea. At its broadest part this valley is probably about 40 miles wide. The capital, Kuala Trengganu, is grouped in picturesque fashion about the foot of low conical hills which afford a pleasant contrast to the generally flat character of the coast country. The next most important river is the Kemaman, which traverses the southern portion of the state, and which, like the Trengganu, is navigable by large river boats for a distance of 30 or 40 miles from the sea. In places both rivers attain great depths, sometimes as much as 60 feet; but for the most part they are shallow and rapid. Other rivers are the Stiu, north of the Trengganu, which is both deep and infested with crocodiles, a most unusual occurrence on the east coast of the Malay peninsula, the Marang, the Dungun, and the Besiut, the valley of the last-named supporting a considerable population. The southern boundary, dividing Trengganu from Pahang, is of uncertain position,

both states claiming the Chendar river, from whose banks much valuable timber is obtained.

According to Mr. Clifford, the natives of Trengganu are quite the most ingenious and among the most industrious Malays in the peninsula. They have the reputation of being most zealous Mohammedans, though, as in Kelantan, some of the primitive superstitions of the people die hard, and the standard of culture is comparatively high. A dozen years ago Mr. Clifford estimated the total population at nearly 100,000, about half of whom are collected in the valley of the Trengganu river. In 1905 the native official estimate was nearly 115,000. There is a comparatively large manufacturing class, and the state has been described as the Birmingham of the peninsula. The chief manufactures are silks, cotton fabrics, native weapons, and metal and woodwork. Some good kinds of silk cloths are made, but the genius of the people of Trengganu, like that of all Malays, is imitative rather than creative, and a large part of the production consists of imitations of high-priced cloths. The actual weaving is done almost exclusively by women. There is a considerable industry in the making of brass vessels, and the natives show considerable skill in the casting of brass with certain alloys to produce a white metal. Here again the people of Trengganu have a perfect genius for manufacturing spurious "antiques," which they praise so highly and insist so stoutly are the genuine article that they have gained a reputation as unequalled liars.

From November to March the terrible north-east monsoon comes sweeping round the coast of Cambodia, and visits its full fury on the shores of Trengganu. But for the rest of the year the fishing population works very hard, and has acquired a good reputation for boat-building. Inland the principal cultivations are rice, maize, tapioca, yams, gambier, coconut, sugar-cane, and fruit trees. Rattans are cut in large quantities, and form a considerable portion of the freight to Singapore for transhipment to London and New York. Copra is dried in the sun and exported, and though only a small quantity of coconut oil is sent away, the trade in this product is capable of great development, as the coconut palm grows in the state in great abundance.

The Sultans of Trengganu have sent the Bunga Amas, or triennial gift of Golden Flowers, to Bangkok ever since the latter half of the eighteenth century, but they have always denied that this was in the nature of a tribute to Siam. The Government still retains its character as a weak, inefficient, and corrupt Oriental despotism, but during the last decade many British subjects have visited the country with a view to opening up its resources, and, under a reformed administration, there is no doubt that industry and commerce will take on a rapid development. The country is rich in tin, which is worked by Chinese, and on the Paka river there were recently fully two hundred coolies engaged in washing for tin. Within the last few years valuable

deposits of monazite have been discovered, the specimens sent to this country yielding an unusually high percentage of thorium. Iron ores of a hematitic character have also been noted, as well as traces of galena, but the country has still to be prospected systematically for minerals.

The state of Keda lies on the opposite side of the peninsula fronting the straits of Malacca. It came under definite Siamese control in the third decade of the nineteenth century, and since September, 1905, has had the advantage of the services of a British financial adviser, Mr. G. C. Hart, appointed by the King of Siam. The coast-line of the state measures between 60 and 70 miles, and its area is stated by Mr. Hart, in his first annual report, to be about 3045 square miles. A fertile coastal plain—broken by Gunong Jerai, or Keda peak, which rises to a height of about 4200 feet, and overlooks Penang—gives place in the interior to broken hilly country. Among numerous rivers, which form the principal means of communication in the interior, the longest is the Muda river, a shallow stream of which the source has still to be correctly mapped, and which is navigable only by vessels of the lightest draught. The principal tributary of the Muda is the Baling river, which joins it about 30 miles from its mouth. In the south the Krian river forms the boundary between Keda and Perak, while on the northern side of the state the Keda river traverses in two branches a large paddi-producing district around Alor Star, the capital.

Since the introduction of reforms, Alor Star has become increasingly prosperous. It contains a number of substantial buildings, including the Government offices and law courts; is provided with fairly good roads; enjoys daily steamship communication with Penang; and can boast of a telephone system embracing 75 miles of connections. In 1905 the Rajah numbered the population of Keda at 139,000, but Mr. Hart states that a native census (admittedly unreliable) places the number at 219,000. For the most part the population consists of Malays, but there is a considerable sprinkling of Chinese, especially in the mining districts. Alor Star constitutes a separate administrative district directly controlled by the central government, and there are six other districts (each administered by a district officer), including the islands of Langkawi, which possess an excellent natural harbour, and are noted for their beautiful scenery, though for the most part the slopes are too precipitous to permit of cultivation.

Native industry in Keda is mainly agricultural in character. Rice is produced in sufficient quantity to permit of a large amount being exported annually. Other cultivations include tapioca, coconuts, rubber (with which a large area has recently been planted), and, in small quantities, coffee and pepper. Owing to the ruthless exploitation of the timber of the state in the past, the forest lands of Keda have been greatly impoverished, and steps have now been taken to limit the export of timber until such time as the previous waste can be made good. Tin-

mining has flourished for a number of years past in one or two districts, but on the whole little has yet been done to test the mineral resources of the state. In Keda and the adjoining states of Perlis (which also comes under British suzerainty) and Situl, there are 185 miles of telegraph line. Among other evidences of recent progress has been the opening of a new school at Alor Star. The revenue for the Mohammedan year 1324 was estimated at $1,105,420, the actual revenue in the latter half of 1323 and the first half of 1324 (August, 1906, to August, 1907) being $917,764. The expenditure for the same period amounted to $816,733.

LIEUT. SHACKLETON'S ANTARCTIC EXPEDITION.

LIEUT. SHACKLETON has achieved a success which places him in the front rank of Polar explorers. Carrying on the work so well begun by Captain Scott, and by the way opened by him, he has, by a bold dash south, pushed forward the farthest outpost of man's advance some 430 miles beyond the turning-point of his former leader, reaching a latitude never before attained in either hemisphere, and only turning when at a distance of little more than 100 miles from the South Pole. This is, too, only one of the results of an expedition which has owed its success to its leader's personal initiative and organizing power, efficiently seconded as these have been by many zealous coadjutors.

By an arrangement made beforehand, the first narrative of the expedition, telegraphed on March 23 from Half-Moon bay, in Stewart island (New Zealand), was addressed to the *Daily Mail*, to which enterprising paper we are therefore indebted, at the moment of going to press, for the opportunity of giving the following brief outline of the expedition's achievements. The details available are sufficient to show that an amount of pluck and determination has been displayed by Lieut. Shackleton and his companions which has never been surpassed in the history of Polar enterprise. It will be remembered that, owing to the impossibility of effecting a landing on King Edward VII. Land, the winter quarters were fixed at Cape Royds, on the west side of Ross island,* a little north of those of the *Discovery*. During the earlier part of 1908, the building of a hut and of stables for the Manchurian ponies was completed, and systematic scientific work set on foot by the several experts. Sledging was begun on August 12, when Lieut. Shackleton started, with Messrs. Armytage and David, to examine the surface of the great Ice Barrier. At this time the low temperature of 57° below zero Fahr. (89° of frost) was experienced. On September 22 another journey was undertaken for the purpose of laying a depôt for the

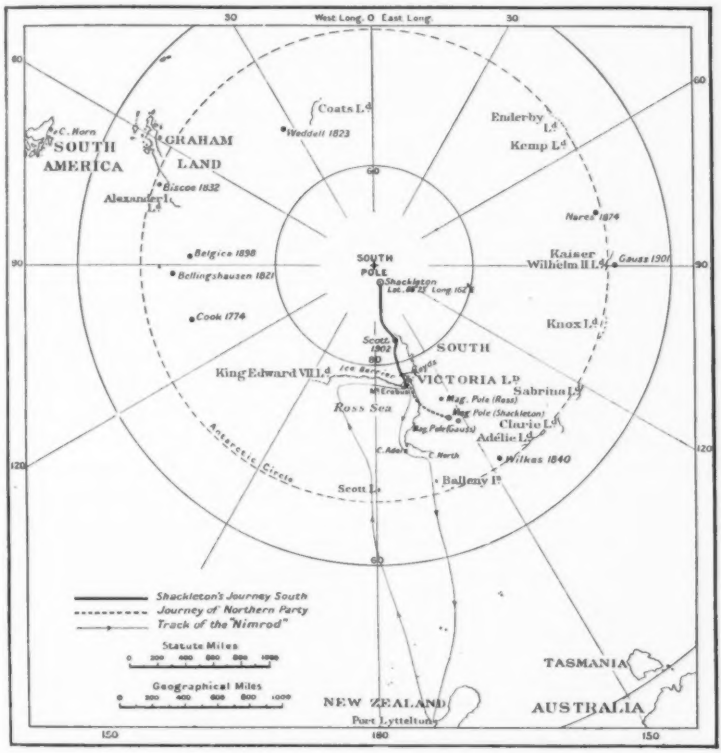
* For the northern portion of the area traversed, the charts of the *Discovery* Expedition issued by the Society are the best authority for the position of places mentioned.

southern journey, which was done at a point 124 miles south of the *Discovery's* winter quarters. The southern party—consisting, besides Lieut. Shackleton, of Messrs. Adams (lieutenant R.N.R.), Marshall (surgeon and cartographer), and Wild—with four ponies and a supporting party, left Cape Royds on October 29, 1908, and Hut point (at the *Discovery's* winter quarters) on November 3. It took with it provisions for ninety-one days. On November 7, after a four days' blizzard had been encountered at White island, the explorers took leave of the supporting party. The general direction for some time was south, along the meridian of 168° E., or somewhat further out from Victoria Land than Captain Scott's route. On November 13, the depôt previously established in 79° S. was reached, supplies from it being taken on, while the daily rations were reduced. High sastrugi (snow-ridges) here alternated with soft snow, in which the ponies often sank to their bellies.

In 81° 4′ one of the ponies was shot, and a depôt made of the meat, with oil and biscuit. On November 26 Captain Scott's farthest (82° 16′ 33″) was reached. The surface was now extremely soft, whilst the ponies were attacked by snow blindness. Two more ponies having been shot, the party approached a high range of new mountains trending to the south-east, and on December 2 the Barrier showed the effects of great pressure, the ridges of snow and ice giving place to land. A glacier 40 miles wide was found to extend in a south and south-west direction, and its ascent was begun on December 5, in lat. 83° 33′, long. 172°. Dangerous crevasses made the advance a slow one, and on December 7 the last pony was lost in one of these, though Mr. Wild and the sledge were saved. The men were now hauling 250 lbs. each. They frequently fell into crevasses, but were saved by the harness and pulled out by an Alpine rope. On December 18 an altitude of 6800 feet was attained, and on the 26th (after another depôt had been made, and rations once more reduced) a plateau was reached by ice-falls at 9000 feet, the elevation gradually rising in long ridges to 10,500 feet. The second sledge was now discarded, the explorers pushing on in a constant southerly blizzard, with the temperature ranging from 37° to 70° of frost. On January 4, finding themselves growing weaker, they proceeded with one tent only. The surface became soft, and the blizzard raged for sixty hours with increased violence, the men being frequently frost-bitten in their sleeping-bags. Finally, on January 9, the latitude of 88° 25′—the highest ever reached by man—was gained in 162° E., the last part of the route having thus inclined somewhat to the west. Here the Union Jack presented by the Queen was hoisted, and the return march begun. From the turning-point no mountains were visible, but a wide plain stretched towards the south, no doubt as far as the pole.

The decision to return was evidently not taken a day too soon, for the journey to the ship was made under intense hardships, which must have tried the men's endurance to the utmost. Fortunately, the blizzards

continued to come from the south, which to some extent helped progress; but food again and again ran out before the depôts were reached, while to add to their distresses, dysentery—a result of the diet of pony-flesh—broke out, the entire party being at one time prostrate. The descent of the glacier was slow and difficult, the snow having been blown from its surface. On February 23 a depôt on Minna bluff, laid by a party under Joyce in January, was reached; but Marshall suffered severely from a



return of dysentery, and on the 27th was left in camp with Adams, while the leader and Wild made a forced march to the ship to bring aid. On March 1 Lieut. Shackleton returned with a relief party, and all reached the ship at Hut point on March 4. The total distance covered, including relays, was 1708 miles, and the time occupied, 126 days. The main results had been a good geological collection (including specimens of coal found in association with limestone), a complete meteorological record, the discovery of eight distinct mountain ranges and many separate

peaks, and the survey of a number of glaciers. Traces of a former greater glaciation were seen, while the violent blizzards encountered in 88° showed that the supposed area of calm must be small in extent, or not coincident with the geographic pole.

Meanwhile another important expedition had been carried out to the north-west by Prof. Edgeworth David, accompanied by Messrs. Marson and Mackay. It left Cape Royds, for the South Magnetic Pole, on October 5, 1908, travelling north over the sea-ice, parallel to the coast, as far as 75°, beyond which it struck inland, in the neighbourhood of the Drygalski glacier. After many difficulties from crevasses, while travel was made trying by strong southerly winds and shortened rations, the party made its way to an inland plateau over 7000 feet above the sea, and on January 16 reached the Magnetic Pole, which Marson determined, with a Lloyd-Creak dip-circle, to be in the vicinity of 72° 25′ S., 154° E. The position as deduced from the *Discovery* observations is 72° 51′ S., 156° 23′ E. Returning, the party reached the Drygalski glacier, near Mount Larsen, on January 30, experiencing great difficulties in its descent. Arrived at the sea-ice, this was found to have broken up, cutting off retreat. The outlook was serious, but the explorers were fortunately rescued by the *Nimrod*, which, following Lieut. Shackleton's instructions, was carrying out a search for the northern party along the coast of Victoria Land. A western expedition under Armytage, Brocklehurst, and Priestly had also done some good work in the neighbourhood of the Ferrar glacier, making geological collections and taking photographs.

Another interesting piece of work, carried out in 1908 after the first arrival at the winter quarters, was the first ascent of Mount Erebus, the present crater of which—half a mile in diameter and 800 feet deep—was at the time ejecting vast volumes of steam and sulphurous gas.

The return voyage in the *Nimrod* was begun immediately on Lieut. Shackleton's return, an attempt being made to explore the northern coast of Victoria Land *en route*. This led to the sighting of a new range of tabular mountains trending south-west and west for 45 miles beyond Cape North. On March 9 the ship was temporarily beset, but soon got clear, and arrived, all well, at Half Moon bay, after a boisterous passage, on March 23.

The expedition appears to have secured valuable results in various departments of science. Besides Prof. David, of Sydney University, the staff included Mr. James Murray (as biologist), and other competent observers, and full attention was given to the meteorological record, observations of the movements of the upper atmosphere, of the aurora displays, and other phenomena. The first exact location of the South Magnetic Pole is a valuable achievement, while the geological collections, preserved amid all the hardships of the southern expedition, are likely to prove of special interest.

REVIEWS.

ASIA.

Eastern Asia.

'A Wandering Student in the Far East.' By the Earl of Ronaldshay, M.P. Two vols. London: William Blackwood & Sons. 1908. 21*s. net.*

Lord Ronaldshay has combined in the present work a series of studies on the Far East with notes on a journey across China to Burmah, following the Yangtse to Chungking, and then travelling overland to Chengtu, Sui Fu, Yunnan Fu, and Tali-fu to Bhamo. Throughout the whole work the reader is confronted with evidence of how carefully each subject has been studied, and of how not only blue and other books, but also all persons on the spot, who can speak with authority, have been consulted.

In China the Yangtse gorges, *i.e.* that portion of them which lies between Ichang and Chungking, have naturally attracted very careful attention from the traveller, whose verdict is adverse to the possibility of their navigation by steam with commercial success. Against him he has a considerable number of local authorities, who hold that not only is steam cheaper than human labour, but that there is nothing in the gorges more formidable than is found on the American continent on rivers where steamers trade regularly. As the province which it is sought to tap holds a population of 68,724,800 souls (according to Père Richard, nine-tenths of these are in the eastern and most accessible part of the province), it will certainly be well to venture a considerable capital in thoroughly testing the possibilities of the river before discarding the scheme as impracticable.

If the same population were to be found in Yunnan as in Sze-chuen, the difficulties which face the construction of a railroad from Burmah to Tali Fu would rapidly disappear, in view of the returns which would follow on the introduction of means of rapid communication. But the author, though strongly in favour of a railroad for political reasons, has to acknowledge that there is no prospect of its proving a paying concern in the absence of any considerable trade in Yunnan.

One of the most interesting chapters in the first volume is that devoted to the different railway routes projected from Burmah into China. In this he refers to the survey recently completed by Mr. Lilley for a metre-gauge railway *viâ* Teng-yueh to Tali Fu, with a ruling gradient of only 4 per cent. as demonstrating the incorrectness of Mr. Baber's assumption that such a railway would have to be a series of bridges and tunnels, and in several places Mr. Baber is charged with having prejudiced the construction of a line by his witticisms on the subject. But the criticism is hardly fair, for after all Mr. Baber never doubted the ability of engineers to construct the line, though he questioned its commercial success. The matter was one which he had much at heart, and in 1887, in a despatch which appears not to have been published, he indicated a route considerably to the east of Teng-yueh as perhaps more promising.

No less interesting are the chapters on the French line from Lao-kai to Yunnan Fu, with the story of its origin and a hint at the political consequences to China and Great Britain which may attend its completion, and on the making of what the author terms the "North-East Frontier," where the Indian Empire, France, China, and Siam meet.

The only point in the whole work which is to be regretted is the lack of a stronger personal element. The notes on the growth of opium, the advance of education, and the spread of a military spirit, of which evidences were seen on the

journey, are very interesting and excite a desire to learn more of what was actually seen at this present time when changes are occurring throughout the country.

Of the opium question Lord Ronaldshay treats at some length. While acknowledging that towards the suppression of opium more has been achieved than was to be expected, he lays stress on the strength of the forces in China which are impeding the execution of the reform, and his own experience certainly proves that the cultivation of opium is being carried on in districts where officially it is reported to have been extinguished. He also believes in the existence of a party which desires the extinction of the foreign opium trade solely in the interest of native opium. The solution of the question must doubtless rest with the people, without whose co-operation the Government is almost as powerless as that of sixty years ago to effect a reform which touches the purses of such a large section of the population, not only official, but also commercial and agricultural.

Though the blood is beginning to move in the veins of China, it is a relief to turn from the contemplation of that country to Japan. In spite of the burden of present taxation, the industrial and commercial activity is depicted as immense, and only surpassed by that of the naval department, even under a restricted programme. With 12 battleships, 12 armoured and 52 other cruisers, 55 destroyers, and 78 torpedo boats, Japan has twice the tonnage and in battleships twice the number of the vessels with which she faced Russia. The construction of battleships of 20,800 tons and cruisers of 18,400 tons, with an unusual number of 12-inch guns, is being hastened to completion. Lord Ronaldshay's essays on these and similar questions are thoroughly up to date and full of statistics. The only side of Japanese activity which is left untouched is the army.

With Japan's work in Korea and Manchuria the author concludes his review of the Far East. The chapters on Korea contain the history of that unhappy country since 1904. In the chapter on Manchuria, the prominent place is of course occupied by the railway questions with China, and Japan's attitude as regards the open door to trade. As to the latter point, the charge of failure to observe her promise is held by the author to be not proven.

W. R. C.

An Asian Problem.

'The Pulse of Asia: a Journey in Central Asia illustrating the Geographic Basis of History.' By Ellsworth Huntington. London: Constable. 1907. *Maps and Illustrations.* 14*s. net.*

Is there a climatic pulse in Asia? a definite and measurable recurrence of certain phases of climate, responsive, possibly, to those laws of nature which regulate the Earth's motion in space? Mr. Huntington thinks there is, and he has spent two years in collecting evidence thereof by means of careful and painstaking observations in Central Asian regions. He is fully impressed with the fact that one of the chief factors in determining the course of history is geography, and that among geographic forces changes of climate have been the most potent. So he commences with a careful description of the physical features of five great Asiatic basins—Kashmir, Lop, Turfan, Seistan, and the Aralo-Caspian depression, noting with due emphasis the influence of infinitely varied physical environment on the habits, thought, and character of their inhabitants. He then, with the aid of a well-constructed map which leaves little to be desired in point of clearness, illustrates the change which has occurred in the great Lop basin within the last two thousand years due to the process of desiccation and its consequent results as regards the social life and character of the people. No one will dispute such evidence. It has lately received remarkable confirmation from the observations

of Dr. Stein, whose more elaborate and scientifically constructed maps will be of immense service in the elucidation of Central Asian problems such as these. Nor will any student of Asiatic history question the validity of the arguments which support the proposition (not a very new one) that it was the effect of climatic changes, probably representing deficient rainfall, that, under the eternal law of necessity for existence, first set Central Asian hordes moving from their over-crowded valleys, displacing surrounding tribes and spreading in ever-widening waves of human emigration to the west and the south. At the particular period of the world's history when these tremendous human movements were most active, *i.e.* about two thousand years ago, Europe seems to have been undergoing a climatic change which we might say was "for the better." It was growing warmer and moister, and consequently more attractive to the hardy barbarian than his own sterile wastes. Thus are we relieved from a natural apprehension lest the periods of desiccation should be synchronous over the whole habitable globe. The effect of the drying up of water-supply on a pastoral community is well illustrated by Mr. Huntington when he points out that the difference between, say, 13 inches of annual rainfall and half that amount is equivalent to the difference in food-supply of fifteen sheep or of one; but he denies that the failure of moisture is to be attributed generally to deforestation, the actual amount of rainfall not being influenced by forest growth, but only its distribution. These climatic changes are said to occur in cycles, and Mr. Huntington adopts the theory that just as geological investigation has established recurrent glacial epochs at one end of the scale, and Bruckner has proved the existence of certain recurrent climatic phenomena in periods of thirty-six years at the other end, so we may look for an intermediate pulsation, the beats of which are to be reckoned by thousands of years, which will be coincident with regular fluctuations of rainfall and temperature throughout the world. It may be so, but surely it requires the evidence of a recurrent period of prosperity in Central Asia to prove it. We can only hope that the world is approaching that period in its history at which the pendulum is about to swing back. With the almost universal evidence of gradually increasing desiccation through the continents of Asia and America (especially South America), and similar indications in Western Africa and Northern Europe, we see at present no evidence of an equivalent increase of moisture to counterbalance the deficiency anywhere. Is there really a universal pulse—or are we drifting, like Mars, into eternal sterility? If the perusal of Mr. Huntington's book has not left us fully convinced of the truth of his theory, it has at least left an impression of most delightful reading. It is interesting from the first page to the last—in short, it is one of the best of the many books of Central Asian travelling that have ever been written.

T. H. H.

AFRICA.

The Congo Basin.

'George Grenfell and the Congo.' By Sir Harry Johnston, K.C.B., D.Sc., etc. 2 vols., 496 *Illustrations, and* 14 *Maps.* Hutchinson. 1908. xxiv. + 990 pp. 30*s. net.*

This leading title is followed by a very long sub-title, which, in old-fashioned style, fills the whole of a page, and conveys a somewhat adequate idea of the comprehensive character of the author's truly encyclopædic work. From it the reader will at once learn that he will here find, not only an ample account of the missionary labours and geographical explorations of the "Central African Livingstone," but also some most attractive essays on a multiplicity of topics directly or indirectly connected with the main subject. Thus, with Congoland are included the neighbouring Cameroons and Fernando Pô, besides a detailed history

and description of the Congo State proper, its fauna and flora, its Negrito, Bantu, and other inhabitants, all very fully treated, practically at first hand, from the copious data drawn from the unpublished diaries, researches, and correspondence of Mr. Grenfell and his missionary colleagues, supplemented by much valuable information contributed by the Rev. L. Forfeitt, Mr. E. Torday, and the author himself, who is here often on familiar ground.

All this superabundant material, derived from so many different sources, has been conveniently disposed in two bulky volumes of about equal size, and inseparably connected by continuous pagination, an arrangement which should always be adopted in such cases, as dispensing with two indexes, and otherwise greatly simplifying reference to the varied contents. Here all the incidents of travel, geographical research, missionary work, and relations with the Congo Independent State are brought together in the first volume; while the second is exclusively anthropological, linguistic, and biological in the wider sense. Between the two the author has executed with rare skill and judgment his formidable task, which is by no means confined to the work of Grenfell, but combines with an account of his geographical and scientific explorations "a survey of the contributions to science and to our general knowledge of West Africa provided by the Baptist Mission of Great Britain from the arrival of Dr. Prince and the Rev. John Clarke at Fernando Pô in 1840 down to the present day."

Grenfell's claim to rank with Stanley as one of the two foremost explorers of Congoland is here fully vindicated and confirmed by unquestioned independent testimony, such as that of E. Baccari, who refers to him as "an explorer, astronomer, meteorologist, geographer, recognized in the scientific world as amongst the very greatest of African pioneers." To the question, What has he done to earn such universal recognition, crowned by the Gold Medal of our Society in 1886, before half of his lifework was done? the reply might almost be, What has he not done within the wide sphere of his scientific and civilizing operations? In any case a complete answer is given in the following extract from A. J. Wauters' obituary notice in the *Mouvement Géographique*, March 10, 1907. The length of the quotation may be excused, since it will dispense with the necessity of going into further details, for which there is here no space, on the subject of Grenfell's geographical discoveries:—

"George Grenfell is one of the noblest figures in the history of the Congo Independent State. He explored and evangelized Central Africa after the methods of Dr. Livingstone, whom he resembled in his medium stature, his kindly disposition, his natural gentleness, his enquiring and open turn of mind. . . . Stanley revealed the course of the Congo from Nyangwe to Boma, Wissmann discovered the Kasai, and Wolf the Sankuru. It is to Grenfell that we owe the earliest surveys of most of the other navigable Congo affluents. During one of his first excursions, begun in October, 1884, he ascended the Mubangi, the Mongala, the Itimbiri (Rubi), and the Lomami. In 1885 he again penetrated up the Mubangi to the Zongo falls, and explored the Ruki and the Lulongo in company with the German Captain von François. In 1886 he surveyed the course of the Kwango, and finally completed by a reconnoitring expedition up this river and in the Lunda lands the cycle of great discoveries which he had just made, revealing the existence of peoples dwelling along the banks of a marvellous network of open waterways, a network which doubles the economic value of the Congo itself."

Mention should also be made of the magnificent map of the Congo between Stanley pool and Stanley falls, which has been published by the Royal Geographical Society, and is based entirely on the data supplied by Grenfell.

The much-discussed question of his attitude towards the Congo State and King

Leopold is here treated in an extremely impartial spirit, and it is made abundantly evident that he never connived at the atrocities inflicted on the natives.

In the volume devoted almost entirely to anthropological subjects, the leading feature is a serious attempt made by Sir Harry Johnston to introduce some order into the confused ethnical relations hitherto prevailing throughout Congoland and neighbouring regions. This is not the place to deal with these matters, the less so since they lie beyond the sphere of Grenfell's lifework. It must therefore suffice to say that, whether his views regarding the origin, successive migrations, and classification of the Bantu and non-Bantu populations be accepted or not, very great credit is due to the author for the immense trouble he has evidently taken to work out and establish his peculiar theories.

The work is profusely illustrated with nearly five hundred reproductions of photographs taken by Grenfell and his associates, and from several drawings by the author. There is also a copious subject-index, besides fourteen maps, some on a large scale, and all useful aids to the understanding of the text. Attention may be called more particularly to the sketch-map showing by shadings the scenes of the slave-trade and other wars since 1885, and to the "Concessions map," exhibiting at a glance the areas of the Congo State withdrawn from free trade against the Berlin Convention.

A. H. Keane.

POLAR REGIONS.

Arctic Researches.

'Conquering the Arctic Ice.' By Ejnar Mikkelsen. London: Heinemann. 1909. *Price* 20*s*.

This book contains an interesting account of one of the most gallant attempts that ever was made to solve an Arctic problem. From a geographical point of view it is a very important problem, as a glance at any map will show. Sir Robert McClure in 1851, Sir Leopold McClintock and Lieut. Mecham in 1853, discovered the western side of Banks island and Prince Patrick island, a coast-line several hundreds of miles in length, broken in one place by McClure strait, 50 miles in width. Since 1853 no one has approached that coast-line. Tremendous pressure was observed along its whole length, by ice of great age and thickness, and similar ice forces its way down McClure strait, impinging on the north-west coast of King William island. From Banks and Prince Patrick's islands to Siberia there is a vast unknown area, which has received the name of the Beaufort sea. The problem is to explore that area, to ascertain whether any land exists within it, to obtain soundings, and to discover the nature and drift of the ice, and the currents.

At first the cause of the great age and thickness of the ice was attributed to the existence of land to the northward, which confined it and caused an increase of thickness year by year. This solution seemed to be confirmed by the existence of Eskimo encampments of great antiquity along the whole length of the Barry islands. It was thought that these wanderers, coming from Siberia by the supposed land, had pressed onward until they reached a region where it was possible to maintain life permanently, on the shores of Baffin's bay.

The expedition of 1875 threw a new light on the question. It was found that similar ice was pressing on the north coasts of Greenland and Ellesmere island. Reviewing the whole question, it then appeared that there was a continuous general movement across the polar area from the Asiatic to the American side, with only one outlet down the east coast of Greenland. This was confirmed by the results of Nansen's expedition, and accounted for the heavy ice along the shores of Banks and Prince Patrick's islands. But there are cogent arguments in favour of both

hypotheses, and the exploration of the Beaufort sea is still the most important of all the Arctic problems.

There was a time when our Government recognized the exploration of unknown regions and the solution of geographical problems, for the encouragement of enterprise and in the interests of commerce and science, as a duty. That duty is recognized most emphatically in the instructions to Admiral Byron. But now it is neglected and left to private volunteers with inadequate means, thus increasing the difficulties a hundredfold.

Undaunted by these difficulties or by the magnitude of the enterprise, a young Danish sailor came forward in 1905 to solve the mysteries of the Beaufort sea. Einar Mikkelsen has every qualification for the task except funds. He is a thorough seaman, a good observer, and had acquired experience in ice-navigation and sledge travelling during service in the Ziegler expedition to Franz Josef land. Resolute and persevering, he is painstaking and endowed with inexhaustible patience. His sunny good nature and kindness of heart are combined with sufficient firmness and insight into character. Mikkelsen was an ideal Arctic commander, and he was very fortunate in his colleague, Mr. Leffingwell, who undertook the scientific work of the expedition.

The original plan was to make a large depôt on Banks island, and to start from the north-west coast of that island with dog-sledges in a west-north-westerly direction for forty days, and then make for the continent near Cape Barrow. Such a journey would be perilous in the extreme and very difficult, but it would fix the position of the continental shelf west of Banks and Prince Patrick's islands, decide the question of land, and throw light on the conditions prevailing over an important Arctic area.

Under favourable circumstances, the achievement of this great enterprise was just possible. Unfortunately, the circumstances proved to be most unfavourable. Sufficient funds could not be collected. The stores and equipment, with the two explorers, were to have been taken up in a whaler and landed on Banks island. But all the whalers had been obliged to winter in the ice, except one, which was loaded up with provisions for the others, and could take nothing for the explorers. They, therefore, were obliged to buy a leaky old schooner and to take out a scratch crew, hoping to pay the wages from the proceeds of her sale. It was a still greater misfortune that the season was an unusually bad one. Cape Barrow could not be rounded until September, and they were forced to winter at Flaxman island, on the North American coast, close to Camden bay, where Captain Collinson wintered in the *Enterprise* in 1850–54. It had thus become impossible to reach Banks island or to carry out the original plan. It only remained to make a long sledge journey northward from the American coast, and to ascertain the position of the continental shelf in that direction.

Mikkelsen devoted the winter to preparations for the journey in the spring. His chapter on the equipment of a sledge expedition shows the care and thought he devoted to the subject, examining the equipments and arrangements of every previous expedition down to the minutest detail, and weighing the results. It is a chapter which will be of permanent value to future Arctic explorers. The party consisted of Mikkelsen, Leffingwell, and one other man, with three dog-sledges, and their struggle with the ice lasted for sixty days. Every difficulty encountered in Arctic travel combined to oppose their progress. Not only rough ice and ridges of hummocks rising to 30 feet, not only soft snow and furious gales, but, worst of all, the floes were constantly breaking up and separating, leaving wide lanes of open water. Even this last obstacle had been foreseen, and a raft was designed which answered its purpose. Experience suggested a still better contrivance, which Mikkelsen describes for the benefit of future travellers.

The journey was successful in its object, which was to ascertain the position of the continental shelf off the coast between Cape Barrow and Camden bay. So far the title of the book is justified. The ice which would have prevented most men from achieving this object, was conquered by these gallant young explorers.

The most important matter was the arrangement for taking soundings. A Lucas machine was used, lashed to the stern of the sledge, weighing 13 lbs., and 620 metres of 18-stranded copper wire $1\frac{1}{2}$ millimetres thick, with two leads of 6 and 12 lbs. At a distance of 32 miles from the land the depth was 44 metres, at 63 miles it was about the same, but 2 miles further north it was 690 metres and no bottom. Here then was the shelf, and there could be no land near that meridian of 148° W. The chapter describing the journey over the pack-ice, with the numerous adventures, hard work, and hairbreadth escapes, is most interesting.

On their return the explorers found that another great misfortune had befallen them. The little schooner had filled and sunk. The scratch crew was sent home in a whaler. Mr. Leffingwell determined to remain out for another year with the Eskimo, to complete his scientific observations. Mikkelsen returned practically alone, over 3000 miles of the Alaskan coast in the depth of winter, and his account of this very remarkable journey is not the least interesting chapter in his book.

In spite of difficulties and dangers, such as few have had to encounter, under such an extraordinary combination of adverse circumstances, these dauntless young explorers achieved a success. They ascertained one important point with regard to the Beaufort sea, and they performed this service to geography with distinguished zeal, resolution, and ability. But the main problem remains to be solved. It will be fortunate if men with equal qualifications can be found to attempt it.

C. R. M.

THE MONTHLY RECORD.

EUROPE.

Early Expansion of Russia.—Mr. C. R. Beazley has supplied a chapter in the history of Russian expansion towards Asia and the Arctic ocean, hitherto almost unknown to English readers, in an article contributed last year to the *American Historical Review* (vol. **13**, No. 4), of which we have received a reprint. To the ordinary reader, the history of the Russian advance across the Urals virtually begins with the adventurous career of Yermak towards the end of the sixteenth century, so that the account here supplied of the earlier enterprise in the same direction from about 1100 A.D. onward is of unusual interest, even though the amount of ground covered in those days, to the east of the Urals, was of no very great extent. The leading part in the first discovery and conquest of the north and east seems to have been played by the Old Novgorod on the Volkhov, which, as Mr. Beazley puts it, "in position and importance, as the chief town on the Neva or Gulf of Finland basin, roughly answers in mediæval history to St. Petersburg in modern." Reaching the Pechora in the course of the eleventh century, the pioneers ascended by its headstreams into the heart of the Northern Ural highlands (where the "Iron Gates" of the chronicles must be sought), and early in the twelfth century had made their way as far as Yugra and the valley of the lower Ob. In spite of considerable vicissitudes, into which we cannot enter here, this Siberian connection appears to Mr. Beazley to have been "fairly persistent throughout the central and later Middle Ages; and when in the fifteenth century the Novgorod sphere of influence in the north is finally torn away by Moscow, the Moscovite power, without

loss of time, begins to interfere in Yugra, subjugating it far more thoroughly than before to its new Russian overlord." It was under Ivan the great (1462–1505) that the overthrow of Novgorod and the subjugation of the Ob region took place, three separate Siberian expeditions being undertaken by that prince, in 1465, 1483, and 1499. Mr. Beazley describes also the dealings of Novgorod and Moscow with the northern regions west of the Urals during the Middle Ages.* Here the same rivalry between the two powers was maintained, now the one, now the other, gaining the mastery, though here too the Moscovite autocracy finally triumphs over its turbulent, mob-governed rival. Popular government, Mr. Beazley remarks, had been tried and found wanting among the eastern Slavs. The paper concludes with some interesting remarks on the influence on the course of the history of the physical features of the northern region, especially the river-system, which, like that of North America, favoured an advance from one river-basin to another. Where the main rivers flow from south to north, tributaries generally supply a serviceable route in a transverse direction. The hill-country, on the other hand, seems to have offered little hindrance, though it is certainly remarkable that some of the invasions should have been made over the savage and difficult northern portions of the range, and in winter. Finally, attention is called to the fact that the conquests of the Novgorod pioneers were primarily those of trade-expansion.

Austrian Expedition for the Investigation of the Battlefields of the Second Punic War.—With the assistance of the Vienna *Akademie der Wissenschaften*, Dr. Johannes Kromayer, Prof. of Ancient History in Czernowitz University, carried out a new expedition in 1907 and 1908 for the investigation of the battlefields of the Second Punic War. An Austrian, an Italian, and a French military expert took part in the expedition. On the topography of the battle of Trebia authorities differ, Polybius assigning it to the left, but Livy, on an unforced interpretation, to the right, bank. A fortnight's thorough inspection of the ground led to a conclusion, in agreement with Mommsen, Nissen, etc., but in opposition to Grundy, in favour of the left bank. A decision in favour of the right bank would involve the assumption of a complete change in the character of the ground since 218 B.C., an assumption unnecessary in the case of the left. After this battle, Hannibal, in the opinion of Kromayer, crossed the Apennines by the Collina pass, leading to the plain of Pistoja on the middle Arno. Had Hannibal, according to another opinion, descended with his army into the swamps of the lower Arno, he would, in the judgment of Major Pittaluga, the Italian expert on the expedition, have deserved to be court-martialled. Nor, as the expedition was unanimously convinced, did Hannibal march through the Casentino. Next, as to the location of the battle at Lake Trasimene (217 B.C.). In opposition to the German view, which assigns it to the lake's north edge, and in agreement with the English, the expedition found the topographical conditions which made the battle possible to exist solely on the north-east shore between Passignano and Mount Colognola. This conclusion was brilliantly confirmed by an old map of the sixteenth century, shown in the Umbrian Exhibition held at Perugia. Next year followed the interesting strategic war in which Hannibal made his stand at Gerontium, against Fabius Maximus. As to its localization, the results of Italian and German research are at variance. The expedition decided in favour of the German view, which locates Hannibal's position at the Castle of Dragonara, as against the Italian view, under which the Carthaginian army must have wintered amid snowy

* Like the late Mr. Seebohm, Mr. Beazley speaks of these western regions as Siberia-in-Europe—an expressive term, though one that does not appear to have any sanction in actual usage.

heights. In this episode of the campaign, Hannibal's positions and changes of position were all topographically determined, illustrating the whole wearing-out character of the war, to which before, and especially after Cannæ, Hannibal, sorely against his will, was reduced to submit. The localization of the fight at Cannæ, again, is a counter-question of right and left bank. Here the ground offers no determining point, both banks below, and one at least above the town, being completely flat. The expedition's decision was in favour of the right bank below Cannæ. A march on the hilly left bank is not supported by the authorities, and a Carthaginian offer of battle on the right bank above the town would, in face of the much more favourable situation of the Romans, have been an act of folly. The next point was the position of Hannibal's camp in the Tiefate mountains, during the winter spent near Capua. Hitherto, following the 'Tabula Peutingeriana,' it has mostly been fixed on the north-east slope—a place quite unsuitable for an army abounding in cavalry. Captain Veith will have the camp located on the lower plateau in the interior of the mountains, where were rich pastures for the horses and convenient openings for sorties. The localization of the battlefield on the Metaurus was decided in favour of the conclusion at which Pittaluga had previously arrived, and in opposition to Italian and German views, which were found to be, in a military sense, impossible. Coming now to the African theatre of war, the expedition had to decide the position of battlefields between competing places no longer approximate to, but as much as 80 miles apart from, one another. In this region the ruling geographical factor was water-supply. Only the district of Sidi Yussel offers the water-conditions which Polybius credits to Zama. To the south of the place adopted by Brunon and Lewal, a place all too confined for the decisive battle of 202 B.C., the expedition found, in a direction towards Mellag, a conformation of ground corresponding to the allegations of tradition. Not Yama, therefore, as is now pretty generally assumed, but Seba Biar, is to be identified with the ancient Zama. Kromayer's purely geographical method of investigation, dispensing with all archæological excavation, is of special interest to the geographer. The one object of investigation was the conformation of the land in its broad features, which, certain details excepted, he assumes to offer to-day the same aspect as it did 2000 years ago. In a comparatively short time, thanks to the facilities accorded to the expedition, not only was its main task accomplished, but in places where the opportunity presented itself, a number of problems of the First and Third Punic War were also solved, as well as problems connected with the campaigns of Julius Cæsar, on which subject Captain Veith of the expedition is a noted expert.

ASIA.

The Mountain Flora of Formosa and its Affinities.—The first serious attempt to deal with the mountain flora of Formosa, as known from recent investigations by officers of the government of the island, has been made in a monograph by Mr. B. Hayata, issued as Art. 19, vol. 25, of the *Journal of the College of Science* of Tōkyō University. This forms in itself a volume of 260 pages, not reckoning a series of forty-one full-page plates with explanations. The bulk of the text is occupied with a systematic description of the known species, but there is an introductory section on the general character and affinities of the flora, which is of considerable interest. The Montane zone treated of embraces all the island above 3000 feet in elevation, with Mount Morrison, the highest peak in the Japanese Empire (13,120 feet), in its centre. The general character of the flora is temperate, a total of 392 species dealt with yielding 320, or 81 per cent., of temperate character, as against 45, or 12 per cent., tropical, and 27 or 7 per cent., arctic, antarctic, or

alpine. A table showing the number of elements common to Formosa and to each of the floristic regions of the surrounding land areas, brings out the fact that the island has the strongest affinity (1) to Central and Southern China, and (2) to Japan. The remaining regions show a lessening degree of affinity in the following order: (3) The Himalayas, (4) Malay peninsula and archipelago, (5) Northern China, (6) North America; while 99 species, or 25 per cent. of the whole, are endemic. But although the affinity is greatest with Central and Southern China as regards the mere number of common species, that with Japan is more striking on a comparison of those elements which give the flora its peculiar features. Thus sixteen species are known from Formosa and Japan only, while those confined to China and Formosa are only half as numerous. The explanation may no doubt be found, firstly, in the similarity of insular conditions in Japan and Formosa; and, secondly, in the probable former existence of a land connection between the islands. The number of endemic species in Formosa may indicate a long separation from other lands, but a comparison with the Philippines in this respect shows that the flora of this archipelago is far more insular in character. The general aspect of the vegetation in the Montane zone of Formosa varies considerably according to height, the gradation being well exemplified on Mount Morrison, which presents various climatical features from sub-tropical, through temperate, up to cold regions.* The vegetation zones may be thus defined: (1) broad-leaved tree region, 2000–6000 feet; (2) coniferous region, 6000–10,000 feet; (3) shrubbery region, 10,000–12,000 feet; (4) grass region, 12,000–13,100 feet.

AFRICA.

Snow on the Western Atlas.—Prof. Lemoine gives a short note on the snow-covering of the summits of the Western Atlas in the *Zeitschrift für Gletscherkunde*, Band III. Heft 1. Over the greater part of the range the winter accumulation is considerable enough on the passes to impede travel from December to April. But while there seems no doubt that a few of the summits have snow all the year, none appears to possess glaciers or even névé-fields. M. Gentil is quoted as expressing a doubt whether even the Jebel Sirona, said by de Foucauld to be covered with perpetual snow, really keeps it through August and September. Prof. Lemoine points out the desirability of a study of the question on the spot by a trained glacialist.

Commandant Bordeaux's Journeys east and north of Lake Chad.—These journeys, which were described in *La Géographie* for October, 1908, have already been referred to in the *Journal*, but their interest is such as to warrant a somewhat fuller account. The first was made in the direction of Abeshe, capital of Wadai, for the purpose of reprisals against the Wadai troops for raids on the French territory. It led through districts in part untraversed by Europeans. From the Soro (as the old river-bed formerly known as the Bahr-el-Ghazal seems properly called) the first part of the way led through an uninhabited waterless tract which had to be crossed by forced marches. It is described as a grassy steppe offering not the slightest undulation or sign of animal life. Farther on, the surface becomes more varied, and the clay soil permits the formation in the rains of swampy pieces of water, one of which is fed by the Wadi Rime coming from the direction of Abeshe. Villages of the Derni and Ratani Arabs were found here. Such resistance

* A short account of an ascent of the mountain, by a party under the leadership of Prof. Honda, was given in the *Journal* for January, 1898. Mr. Hayata does not mention Prof. Honda's description (which appeared in a German publication), but alludes to a paper by Mr. Kawakami as the only publication relating to Mount Morrison.

as was offered by the enemy having been overcome, the main object of the expedition was attained, but the commander decided to make a rapid reconnaissance towards Abeshe. The country became better peopled, the inhabitants, who are harshly treated by the ruling race, according the party a friendly greeting. The return journey was made by a more southerly route, part of the caravan travelling by Lake Fittri, while the most fit forced a passage across the waterless belt 120 miles in width, known to the natives (by whom it is avoided as far as possible) as Al Har. The second journey described was a more extensive one, and led to the district of Ei or Endi, on the caravan route from Abeshe to Benghazi, which had not previously been visited by any European, the furthest point reached by Captain Mangin (*Journal*, vol. **29**, p. 569) lying considerably short of it. Again the purpose of the expedition was the punishment of the slave-raiders, who had terrorized the Kanem people for some time and committed other acts of violence. These acts had been carried out by the Zwias—white Arabs from Kufra—who maintain regular posts on the route across the desert, and are subject to the chief of the once powerful Senussi sect. The direction taken was north-east from Mao in Kanem, the route passing through Egei, a district once covered by water (as is indicated by the clay, with fossil remains of fish, which occupies the depressions), and where the underground water comes in places to within a few feet of the surface. Beyond this, three trying marches led across the desert plateau of El Moji, covered with sand and boulders of black sandstone. In Toro shifting crescent-shaped dunes were met with, and the Tedas of the party amused themselves by sliding down the concave side, the movement of the sand causing a sound like the whistle of a large steamer, capable of being heard some 12 miles. The Jurab, south of Borku, is a flat district with water at no great depth, and its vegetation affords pasturage to camels and horses. It was formerly inhabited by the Tedas, and is not, as has been supposed, the name of an old watercourse. The district is said to have once been green and fertile, and to have been traversed by the Sar Sar, a stream which seems to have flowed within the last two centuries, and to have formed a system of interlacing branches, one of which entered Lake Chad near its eastern extremity. After once more crossing an arid plain of sand, the column entered Endi ("the Mountain"), a vast rocky region some 150 to 180 miles in diameter. Some of the masses of sandstone took strange, ruin-like forms, and showed a great variety of colouring. Ethnically and politically Endi is divided into two distinct regions, the west being occupied by people of Tubu race and speech, subject to Wadai; while in the east the Annas or Nakazzas, who speak a language of their own, are subject to Darfur. Here some fighting took place, and a number of women captured by the raiders were set at liberty and allowed to join the caravan. It was now decided to turn west for Borku, where further stiff fighting occurred before the stronghold of the fanatical chief Barani, at Ain Galakka, could be captured. Hence the return was made by a direct route, which soon joined that followed on the outward march.

The German-Portuguese Boundary south of the Rovuma, which had been for some time a subject of local difficulties, was last summer marked on the spot by a joint commission of the two countries. Starting from Lipuu point, just north of Cape Delgado, the frontier runs slightly north of west till it intersects the parallel of 10° 40′ S., which it then follows for the greater part of the distance to the Rovuma, though it takes a somewhat irregular course before reaching that river. It is shown on a map in the *Deutsches Konialblatt* for January 15, which also contains the report of Captain Schlobach, the German commissioner, describing the execution of the task, the nature of the country traversed by the commission, and the condition of the inhabitants. Beyond the zone of coral rock on the coast,

extending some 6 miles inland, rock was exceedingly scarce for most of the distance, and great labour was involved in transporting a sufficient supply for the construction of the thirty-four boundary pillars. A track varying from 20 to 25 feet in width was cleared through the bush or steppe-forest along the line of the frontier, and this will probably be kept open as a line of communication. No compact villages were met with, but many scattered groups of "Shambes," some of which were intersected by the frontier, involving some rearrangement as regards the collection of the hut tax. The Kionga district, between the frontier and the Rovuma, proved much better than its reputation, from the point of view of healthiness, tsetse-fly, mosquitoes, etc. The Swahili inhabitants were friendly, though the tribes along the boundary were shy, and further south the chief Machemba is a disturbing element.

GENERAL.

The Oxford School of Geography.—The Report of this School for 1908 has lately been issued. It states that the increasing work of the school has necessitated additions to the staff and equipment, which have been met by a grant of £200 from the Common University Fund for the current year. Mr. H. O. Beckit, M.A., has been appointed Assistant to the Reader, while Mr. M. M. Allorge has been appointed to a temporary Lectureship in Geomorphology. As regards the future, the fact that the growth of expenditure augments more rapidly than the increase in fees, and the probable withdrawal of the R.G.S. grant at the end of another five years, will soon render it necessary to consider the need of better accommodation and a permanent endowment for the school. Additions to the equipment have lately been made at a cost of about £40. It is proposed to make as complete a collection as possible of maps and official publications of geographical interest relating to all parts of the British Empire, and some generous contributions to this object have already been received. Although the total number of students did not differ much from that of the previous year (the numbers were 65, 59, and 54 for the three terms respectively), the number of those devoting most of their time to geography showed an increase from 17, in the Michaelmas term of 1907, to 30, in that of 1908. Seventeen courses of weekly lectures were delivered, and the usual field, practical, and seminar work was carried on. The fourth biennial vacation course was held in August, 1908, and was attended by 177 students, mostly teachers from schools. As a result of examinations in January and June, the Diploma of the school was awarded to eight candidates (with distinction in the case of two, Miss E. J. Rickard and Miss E. G. R. Taylor), and certificates in Regional Geography or Surveying to five candidates. During the year considerable additions have been made, both by purchase and gift, to the book and map collection.

CORRESPONDENCE.

On the Further Observations of Deep-sea Waves now required.

In view of a forthcoming discussion on observation of waves at sea to be held at the Meteorological Office, the time seems opportune for once more calling the attention of Fellows of our Society to the matter.

For ships engaged in commerce, the ordinary methods, such as have been employed by Lieut. Paris and others,* could be profitably included in the meteorological observations undertaken by officers, and the results would be of much

* *Paris Rev. Mar. et Colon.*, 31 (1871); W. H. White, 'Naval Architecture;' and Vaughan Cornish, *Geogr. Journ.*, May, 1904.

greater value than formerly if use be made of the wireless telegraphy. For this the ships plying on the North Atlantic have special opportunities. Whenever the condition of the sea is such as to make wave observation of particular interest, an effort should be made to get into wireless communication with the vessel immediately preceding and with that immediately following on the same track, and also with the vessel most nearly abreast on the parallel (outward or homeward) track, and the officers of such vessels should be requested to make a simultaneous observation of the state of the sea. The result would be to give much-needed data of the rate of growth (or decay), of height and length (1) in time and (2) in space.

By comparison of the records sent in by different ships following one another, it will be possible to obtain further insight into the relation between the dimensions and speed of the cyclone, or other atmospheric depression, and the height and length of the waves. This is particularly important in connection with the length of the waves, for the growth of that length of wave will be favoured which travels at such a speed as to be accompanied by the depression during its advance across the ocean.* It is thus essential to take account of *two* atmospheric velocities in connection with the growth of deep-sea waves, viz. (1) the velocity of the wind, and (2) the rate of advance of the *locus* of the wind. The part of the cyclone or other depression with which we are most concerned is that where the direction of the wind is identical with the direction of the advance of the depression.

There is one point in which the individual observer may readily improve upon the work of Paris and of most other predecessors, viz. in recording with particular care the effect of a squall during a gale to increase the height of the waves which it strikes. I have repeatedly observed in the Atlantic an increase of, apparently, 5 feet in wave-height during a squall of five minutes' duration, without any noticeable increase of wave-length. This increase in height and steepness is not only interesting in itself, but has a practical application to the designing of torpedo craft and other vessels to resist hogging and sagging strains. Some years ago a torpedo vessel was lost by breaking her back during a gale in the North sea. I doubt if the ratio usually adopted for $\frac{\text{height}}{\text{length}}$, or the steepness, of waves is sufficiently high to represent the groups of steep waves met with during storms, and I suggest that naval architects need fresh data for the ratio on which their calculation of these strains is based. In the case of vessels employed on scientific missions, the officers or members of the scientific staff can elaborate methods of observation which would greatly extend our knowledge of deep-sea waves, particularly by the use of instruments which would enable the total rise and fall of the sea to be measured, thus taking account both of the wind-wave, or "sea," and of the swell. At present, the observations made by eye from ships in motion only give the interval of height, length, and time between successive convexities of surface. The average numerical result for both height and length is thus just the same as if there were no swell running. The total rise and fall of the water is thus considerably underestimated.

VAUGHAN CORNISH, D.SC.

March 6, 1909.

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* The largest swells generally get ahead of the storm, so that the sound of a heavy surf booming at regular and considerable intervals on the shore gives notice of the storm's approach.

MEETINGS OF THE ROYAL GEOGRAPHICAL SOCIETY, SESSION 1908–1909.

RESEARCH DEPARTMENT.

February 18, 1909.—Dr. A. Strahan in the Chair.

'The Isohyets 'twixt the Sahara and Western Sudan.' By Alexander Knox.

Ninth Meeting, February 22, 1909.—Major Leonard Darwin, President, in the Chair.

Elections.—*Edward Amundsen; Lieut. E. H. Bell; Herbert Summersell Davis, M.A.; Joseph O'Conor Donelan; Charles Lincoln Freeston; Major R. N. Greathed, R.A.; James Hodgkinson; Captain Edward Fitzmaurice Inglefield, R.N.; Syed Sirdar Ali Khan; J. T. C. Laing; Eric Brown Lees; F. A. Lindsay-Smith; John M. Maxwell-Lyte; Robert Henry Smith.*

The paper read was:—

"A Recent Journey across Northern Arabia." By Captain S. S. Butler.

Tenth Meeting, February 23, 1909.—Major Leonard Darwin, President, in the Chair.

Discussion of Geographical Problems concerning Tibet, introduced by Dr. Sven Hedin.

SPECIAL LECTURES ON MAPS AND MAP-MAKING.

By E. A. Reeves, F.R.A.S.

First Lecture, March 5, 1909.

Remarks on mathematical geography and maps and map-making generally, followed by a brief description of the principal instruments used in surveying, navigation, and map-making, with a sketch of their history and development from the earliest forms to those of the present time, illustrated by lantern-slides of the instruments themselves and the methods of using them. Specimens of old and new instruments were exhibited.

Second Lecture, March 12.

Lantern-slides of a few early world maps—First attempts at ascertaining the size and form of the Earth—First triangulation computed from a measured base and angles—Measurements by which the form of the Earth was established—Map showing meridian arcs measured and proposed—Early charts and their method of construction—A brief account of present-day survey methods, including triangulation; base-line measurement, with description and slides of apparatus used; traversing, plane-tabling, and determination of heights—The determination of latitude and longitude by astronomical observations, and various other matters of a kindred character were also dealt with. The lecture was illustrated throughout by lantern-slides of diagrams and maps, including facsimiles of some of the maps by famous pioneer explorers.

Third Lecture, March 19.

A brief account of the production of a map, commencing with scales and projections, and passing rapidly through the various stages to the final lithographing and printing—Some of the important points dealt with were the generalization and representation of physical features, selection and writing of names, maps for educational and other special purposes, and the introduction of colour—Numerous diagrams and specimens of good and bad examples of maps were shown on the lecture screen, and examples of map drawing and printing exhibited on the tables.

Eleventh Meeting, March 8, 1909.—Major LEONARD DARWIN, President, in the Chair.

ELECTIONS.—*H. A. Bros; Major-General A. E. Codrington, C.V.O., C.B.; Lieut.-Colonel W. C. Critchley-Salmonson; Charles Maitland Makgill Crichton; John Doubleday; Francis Oliver, LL.B; Alfred L. Johnson; Ernest de Koren Leffingwell; Hon. Ronald Macdonald; William Edward Martyn; Charles Francis Meade; George F. Neame; Morgan Philips Price; Albert Ernest Wearne.*

The paper read was :—

"Explorations in Central Asia." By Dr. M. A. Stein.

GEOGRAPHICAL LITERATURE OF THE MONTH.

Additions to the Library.

By EDWARD HEAWOOD, M.A., *Librarian*, R.G.S.

The following abbreviations of nouns and the adjectives derived from them are employed to indicate the source of articles from other publications. Geographical names are as a rule written in full :—

A. = Academy, Academie, Akademie.
Abh. = Abhandlungen.
Ann. = Annals, Annales, Annalen.
B. = Bulletin, Bollettino, Boletim.
Col. = Colonies.
Com. = Commerce.
C.R. = Comptes Rendus.
E. = Erdkunde.
G. = Geography, Géographie, Geografia.
Ges. = Gesellschaft.
I. = Institute, Institution.
Iz. = Izvestiya.
J. = Journal.
Jb. = Jahrbuch.
k.k. = kaiserlich und königlich.
M. = Mitteilungen.
Mag. = Magazine.
Mem. (Mém.) = Memoirs, Mémoires.
Met. (mét.) = Meteorological.
P. = Proceedings.
R. = Royal.
Rev. (Riv.) = Review, Revue, Rivista.
S. = Society, Société, Selskab.
Sc. = Science(s).
Sitzb. = Sitzungsbericht.
T. = Transactions.
Ts. = Tijdschrift, Tidskrift.
V. = Verein.
Verh. = Verhandlungen.
W. = Wissenschaft, and compounds.
Z. = Zeitschrift.
Zap. = Zapiski.

On account of the ambiguity of the words *octavo, quarto*, etc., the size of books in the list below is denoted by the length and breadth of the cover in inches to the nearest half inch. The size of the *Journal* is 10 × 6½.

A selection of the works in this list will be noticed elsewhere in the "Journal."

EUROPE.

Denmark—Coasts. *Rep. Danish Biological Station* **16** (1908): pp. 62. **Ostenfeld.**
On the ecology and distribution of the grass-wrack (*Zostera marina*) in Danish waters. By Dr. C. H. Ostenfeld. *Sketch-maps and Illustrations.*

Denmark—Coasts. *Mem. on Hydrography* **28** (1907): 222–230. **Sovyetof.**
Changes in the sea-level on the coasts of Denmark. By S. Sovyetof. *Sketch-map.* [In Russian.]

Europe—Cartography. *M. k.k. Militärg. I., Wien* **27** (1907): 96–240. **Hartenthurn.**
Die militärisch wichtigsten Kartenwerke der europäischen Staaten. Nach dem Stande Ende 1907 zusammengestellt von Vinceuz Haardt von Hartenthurn.

Europe—Meteorology. *J. Scottish Meteorol. S.* **14** (1908): 231–237. **Omond.**
The range of monthly mean temperature at Edinburgh, Vienna, and Stockholm. By R. T. Omond. *Diagrams.*

France—Corsica. *C.R.A. Sc., Paris* **147** (1908): 652–656. **Deprat.**
Sur la persistance, à travers toute la Corse, d'une zone de contacts anormaux entre la région occidentale et la région orientale. Par [J.] Deprat.

France—Dordogne. **Hauser.**
Fouilles scientifiques dans le vallée de la Vézère. La Micoque, Laugerie-Basse, Laugerie Haute, Le Moustier, Miremont, Longueroche. Par O. Hauser. (Extrait de *L'Homme Préhistorique*, 6e année, No. 2.) Laugerie-Haute, 1908. Size 10 × 6½, pp. 16. *Illustrations and Sections.*

France—Landes. *B.S.G. Com. Bordeaux* **31** (1908): 221–232. **Saint-Jours.**
Sables marins de la côte landaise. (Calibre et origine.) Par Saint-Jours.

Germany—Bavaria. *Deutsche Rundschau G.* **30** (1908): 433–439, 485–494. **Breu.**
Die südbayrische Landschaft einst und jetzt in orographischer, hydrographischer und floristischer Hinsicht. Historisch-geographische Skizze von Georg Breu.

Germany—Black Forest. *Deutsche Rundschau G.* **30** (1908): 495–497. **Teichmann.**
Der Eichener See. Von Otto Teichmann. *Sketch-map and Illustrations.*

Germany—Brandenburg. *Petermanns M.* **54** (1908): 177–181. **Schütze.**
Die vier schönsten Seen im Lande Sternberg. Von Dr. Hermann Schütze. *Map.*

Germany—Geodesy. **Kühnen.**
Veröffentlichung des K. Preussischen Geodätischen Institutes; Neue Folge Nr. 37. Hydrostatische Höhenvergleichungen von 4 Festpunkten auf dem Telegraphenberge bei Potsdam. Von Fr. Kühnen. Berlin, 1908. Size 11½ × 9, pp. 24. *Plan and Diagrams.*

Germany—Glaciation. **Spethmann.**
Glaziale Stillstandslagen im Gebiet der mittleren Weser. Von Hans Spethmann. (Aus den Mitteilungen der Geographischen Gesellschaft . . . in Lübeck. 2 Reihe, Heft 22.) Lübeck, 1908. Size 10 × 7, pp. 18. *Sketch-map.*

Germany—Hessen. *Geol. Mag.* **5** (1908): 534–542. **Kilroe.**
On the occurrence and origin of laterite and bauxite in the Vogelsberg. By J. R. Kilroe.

Germany—Hessen. *Notizblatt V.E. Darmstadt* **28** (1907): 49–94. **Steuer.**
Bodenwasser und Diluvialablagerungen im hessischen Ried. Von A. Steuer. *Map, Sections, and Diagram.*

Germany—Hessen. *Notizblatt V.E. Darmstadt* **28** (1907): 1–10. **Lepsius.**
Bericht über die 25-jährige Tätigkeit der Grossh. Hessischen geologischen Landesanstalt zu Darmstadt. Von Dr. Richard Lepsius.

Germany—Rhine. *G.Z.* **14** (1908): 372–396. **Knörzer.**
Ueber die Temperaturverhältnisse der oberrheinischen Tiefebene. Von A. Knörzer. *Sketch-maps.*

Germany—Rhine. ———
Ergebnisse der Untersuchung der Hochwasserverhältnisse im Deutschen Rheingebiet . . . bearbeitet und herausgegeben von dem Zentralbureau für Meteorologie und Hydrographie im Grossherzogtum Baden. VIII. Heft: Der Abflussvorgang im Rhein unter der wechselnden Wasserlieferung des Stromgebietes und die Vorherbestimmung der Rheinstände. Berlin: W. Ernst u. S., 1908. Size 14 × 10½, pp. viii., 52, and 56. *Maps and Diagrams.*

Iceland. **Spethmann.**
Vulkanologische Forschungen im östlichen Zentralisland. Von Hans Spethmann. (Separat-Abdruck aus dem Neuen Jahrbuch für Mineralogie, u.s.w., Beilage, Band xxvi.) Stuttgart, 1908. Size 9 × 6, pp. 381–432. *Sections and Illustrations.*

Iceland—Glaciers. *Z. Gletscherkunde* **3** (1908): 36–43. **Spethmann.**
Der Nordrand des isländischen Inlandeises Vatnajökull. Von Hans Spethmann. *Sections and Illustrations.*

Italy—Calabria. **Platania.**
Marine phenomena during the Calabrian earthquake of 1905. By Prof. Giovanni Platania. [Typewritten sheets.] Size 10½ × 8; 32 ll. *Diagrams.*

Italy—Vesuvius. *B.S.G. Italiana* **9** (1908): 862–869. **Baratta.**
La nuova carta del Vesuvio (1 : 25,000) dell' Istituto Geografico Militare. Del dott. Mario Baratta. *Sketch-map.*

Mediterranean—Climate. *M. k.k. G. Ges. Wien* **51** (1908): 237–241. **Ludwig Salvator.**
Warum die Nordseite der Mittelmeerinseln die mildere ist. Vom Erzherzog Ludwig Salvator.

Northern Europe—Fisheries. ——
Conseil Permanent International pour l'Exploration de la Mer. Bulletin statistique des pêches maritimes des pays du Nord de l'Europe. Vol. **2**, pour l'année 1905. Copenhagen, 1908. Size 10½ × 8½, pp. 158.

North-West Europe—Cartography. **Moritz.**
Die Entwickelung des Kartenbildes der Nord- und Ostseeländer bis auf Mercator, mit besonderer Berücksicktigung Deutschlands. Inaugural-Dissertation . . . von Edward Moritz. Halle a. S., 1908. Size 9 × 5½, pp. 86. *Price* 1*s.* 6*d.*
This has been noticed in the Monthly Record (February, p. 211).

Norway—Phytogeography. *Arkiv. Botanik* **7** (1908): No. 11, pp. 72. **Heintze.**
Växtgeografiska anteckningar från ett par färder genom Skibottendalen i Tromsö amt. Af Aug. Heintze.

Rhine. *G.Z.* **14** (1908): 537–552. **Keller.**
Die Speisung des Rheins aus dem Alpen- und Mittelgebirgslande bei Niedrigwasser. Von H. Keller.

Russia—Arkhangel. *Mem. on Hydrography* **28** (1907): 149–221. **Novositzof.**
The Bolshezemelsk Tundra and the Arctic Ocean. By A. Novositzof. *Map and Illustrations.* [In Russian.]

Russia—Perm. *Petermanns M.* **54** (1908): 168–170. **Lebedeff.**
Ein Seengebiet am östlichen Abhange des Ural. (Nach vorläufigen Untersuchungen.) Von Prof. W. N. Lebedeff.

Russian Empire—Historical. **Beazley.**
The Russian expansion towards Asia and the Arctic in the Middle Ages (to 1500). By C. Raymond Beazley. (Reprinted from the *American Historical Review*, vol. **13**, No. 4, July, 1908.) Size 11 × 7, pp. 731–741. *Presented by the Author.*
See note at p. 493, *ante*.

Servia—Ice Age. **Vasović.**
Die Eiszeitspuren in Serbien. Von Prof. R. Vasović. Belgrade, 1908. Size 9 × 6, pp. 48. *Illustrations.*

South-East Europe—Glaciation. *Z. Gletscherkunde* **3** (1908): 1–35. **Cvijić.**
Beobachtungen über die Eiszeit auf der Balkanhalbinsel, in den Südkarpathen und auf dem mythischen Olymp. Von Prof. Dr. J. Cvijić. *Sketch-map, Sections, and Illustrations.*

Sweden—Gothland. *Deutsche Erde* **7** (1908): 82–90. **Ekhoff.**
Gothland und Wisby in ihren Beziehungen zum Auslande, besonders zu Deutschland. Von Dr. Emil Ekhoff. *Map and Illustrations.*

Sweden—Lapland—Glaciers. *Z. Gletscherkunde* **3** (1908): 44–51. **Hamberg.**
Ueber die Methoden der Bestimmung der Gletscherenden und die Schwankungen der Sareker Gletscher in Schwedisch-Lappland. Von Axel Hamberg. *Plan.*

Sweden—Phytogeography. *Arkiv Botanik* **7** (1908): No. 13, pp. 136. **Birger.**
Om Härjedalens Vegetation. Af Selim Birger. *Map and Illustrations.*

Turkey—Macedonia. *M. k.k. G. Ges. Wien* **51** (1908): 242–292. **Nopcsa.**
Die Mineralquellen Makedoniens. Von Dr. Franz Baron Nopcsa. *Sketch-map.*

United Kingdom—Cornwall. *Quart. J. Geol. S.* **64** (1908): 384–400. **Barrow.**
The high-level platforms of Bodmin Moor and their relation to the deposits of stream-tin and wolfram. By George Barrow. *Illustrations.*

United Kingdom—Derbyshire. *J. Manchester G.S.* **24** (1908): 1–4. **Wrench.**
Observations of the Effects of Glaciers in Derwent Valley, Derbyshire. By E. M. Wrench.

United Kingdom—Meteorology. — —
Meteorological Observations at stations of the second order for the year 1904. London: Meteorological Office, 1908. Size 12 × 10, pp. xiv. and 164. *Index-map.*

United Kingdom—Oxfordshire. *Quart. J. Geol. S.* **64** (1908): 335–344. **Spicer.**
Solution-valleys in the Glyme Area (Oxfordshire). By Rev. E. C. Spicer. *Sketch-map and Illustrations.*

United Kingdom—Scotland. *J.R. Anthropological I.* **38** (1908): 212–220. **Beddoe.**
A Last Contribution to Scottish Ethnology. By John Beddoe. *Sketch-map.*
Deals mainly with the pigmentation survey of Messrs. Gray and Tocher.

United Kingdom—Scotland. *Scottish G. Mag.* **24** (1908): 575–587. **Tarr.**
Glacial Erosion in the Scottish Highlands. By Prof. Ralph S. Tarr. *Illustrations.*

United Kingdom—Scotland—Bute. **Millar.**
Glacial phenomena in Bute. By W. J. Millar. (Reprinted from the *Transactions of the Buteshire Natural History Society*, 1907–8.) Rothesay, 1908. Size 8½ × 5½, pp. 4.

United Kingdom—Scotland—Orkneys. *J. Scot. Meteor. S.* **14** (1908): 238–255. **Spence.**
The climate of Orkney. By Magnus Spence. *Diagrams.*
See note in the March number, p. 324.

United Kingdom—Surrey. **Parker.**
Highways and byways in Surrey. By Eric Parker. London: Macmillan & Co., 1908. Size 8 × 5, pp. xx. and 452. *Sketch-map and Illustrations. Price* 6*s. Presented by the Publishers.*

ASIA.

India—Burma and Assam. **Cordier.**
T'oung Pao, II. **4** (1903): 385–406; **5** (1904): 121–156, 239–268; **6** (1905): 61–105; **7** (1906): 1–50, 163–209; **9** (1908): 137–175.
Bibliotheca Indo-Sinica: essai d'une bibliographie des ouvrages relatifs à la presqu'île indo-chinoise. I^re^ partie: Birmanie et Assam. Par Henri Cordier.

India—Corn. **Engelbrecht.**
Die geographische Verteilung der Getreidepreise. Von Th. H. Engelbrecht. II. Die geographische Verteilung der Getreidepreise in Indien von 1861 bis 1905. Berlin: P. Parey, 1908. Size 10½ × 7, pp. viii. and 112. *Maps and Diagrams. Price* 5*m. Presented by the Publisher.*

India—Himalaya. *Alpine J.* **24** (1908): 301–321. **Rubenson.**
Kabru in 1907. By C. W. Rubenson. *Illustrations.*

India—Historical. *G.Z.* **14** (1908): 569–572. **Stübe.**
Die Reise des Afanassij Nikitin nach Indien in den Jahren 1466–72. Von R. Stübe.

India—Survey. *Records Geol. Surv. India* **37** (1908): 1–56. **Holland.**
General Report of the Geological Survey of India for the year 1907. By Sir T. H. Holland.

Indo-China—Ethnography. *B.S.G. Lyon* **22** (1907): 239–305. **Cupet.**
Les populations de l'Indo-Chine. Par le Lieut.-Colonel P. P. Cupet. *Map.*

Japan—Formosa. *M. deuts. Ges. Ostasiens* **11** (1908): 145–212. **Scheerer.**
Ein ethnographischer Bericht über die Insel Botel Tobago (nach R. Toriis Kōtosho Chōza Hōkoku). Von Otto Scheerer. *Sketch-map and Illustrations.*

Persia. ———
Persia. Report for the year ending March 20, 1908, on the trade of the provinces of Seistan and Kain. Diplomatic and Consular Reports. Annual Series. No. 4156. 1908. Size 9½ × 6, pp. 56. *Sketch-map. Price* 4*d.*

Persian Gulf. *Mem. Geol. Surv. India* **34** (1908): Pt. 4, pp. 178. **Pilgrim.**
The geology of the Persian gulf and the adjoining portions of Persia and Arabia. By G. E. Pilgrim. *Maps and Illustrations.*

Philippines—Ethnology. *Deutsche Rundschau G.* **30** (1908): 445–453. **Fehlinger.**
Beiträge zur Ethnographie von Nord-Luzon. Von Hans Fehlinger. *Illustrations.*

Russia—Caucasus—Ethnology. *Petermanns M.* **54** (1908): 204–212. **Dirr.**
Die heutigen Namen der kaukasischen Völker. Von Dr. A. Dirr.

Russia—Siberia—Ethnology. **Jochelson.**
Jesup North Pacific Expedition **6** (1908): 383–842.
The Koryak: material culture and social organization. By W. Jochelson. *Illustrations.*

Russia—Siberia—Rivers. *Mem. on Hydrography* **28** (1907): 276–308. **Polilof.**
The influence of Siberian rivers on the waters of the Arctic Ocean and the Kara Sea. By Dr. Polilof. [In Russian.]

Turkey—Bagdad Railway. *Contemporary Rev.* **94** (1908); 570–591. **Pears.**
The Bagdad Railway. By Edwin Pears.

Turkey—Mesopotamia. *Deutsche G. Blätter* **31** (1908: 147–179. **Kurz.**
Beurteilung der Aussichten auf eine Wiederbelebung der Kultur der Euphrat- und Tigrisniederung. Von Woldemar Kurz.

Turkey—Surface forms. *G.Z.* **14** (1908): 361–372. **Banse.**
Fünf Landschaftstypen aus dem Orient. Von Ewald Banse.

Turkey—Syria. ——
Turkey. Report for the year 1907 on the Trade, Commerce, and Navigation of Beirut and the coast of Syria. Diplomatic and Consular Reports. Annual Series, No. 4142, 908. Size 9½ × 6, pp. 24. *Sketch-map. Price* 2½*d.*

AFRICA.

Belgian Congo—Administration. ——
Moniteur Belge: Journal officiel. 78e Année, N. 293-294, 19 et 20 Octobre 1908. Bruxelles, 1908. Size 13½ × 9½, pp. 5861–5920. *Purchased.*
Contains the "Traité de cession," the act confirming the treaty, and other official documents relative to the administration of the newly formed colony.

Belgian Congo—Administration. ——
B. Officiel, État Ind. du Congo **24** (1908): 391–698.
Traité de cession de l'État Indépendant du Congo à la Belgique.

Belgian Congo—Railways. ——
B. Officiel, État Ind. du Congo **24** (1908): *Annexe* 51–194.
La construction en régie des chemins de fer du Congo supérieur aux grands lacs africains. État actuel des travaux. *Maps and Diagrams.*
Mainly concerned with the lines connecting the Middle Congo with the upper navigable reaches.

Cape Colony. **Herbst.**
Cape of Good Hope. Report on Rietfontein area. By J. F. Herbst. [Cape Town, 1908.] Size 13 × 8, pp. 14.
Also issued as a Colonial Report (Miscellaneous, No. 55). See abstract in vol. **32**, p. 513.

East Africa. *Nineteenth Century* **64** (1908): 567–587. **Johnston.**
The East African Problem. By Sir Harry H. Johnston. *Sketch-maps.*

East Africa—Boundaries. ——
Treaty Series, No. 27, 1908. Agreement between the United Kingdom and Ethiopia relative to the frontiers between British East Africa, Uganda, and Ethiopia. Signed at Adis Ababa, December 6, 1907. London, 1908. Size 9½ × 6, pp. 4. *Maps. Price* 1*s.* 0½*d.*
See note and sketch-map in the December number, pp. 621–622.

Egypt—Hydrology. *Cairo Sc. J.* **2** (1908): 234–242. **Ball.**
Desert water supplies. By Dr. John Ball.

Egypt—Meteorology. *Quart. J.R. Meteorol. S.* **34** (1908): 259–263. **Keeling.**
Upper air investigations in Egypt. By B. F. E. Keeling.

Egyptian Sudan. **MacMichael.**
Notes on the history of Kordofan before the Egyptian conquest. By H. A. MacMichael. 1907. Size 13½ × 8, pp. [10]. *Presented by Major Lee Stack.*
Extracted from an official report.

French Congo. *Renseignements Col., Com. Afrique française* **17** (1907): 224–240. **Lœfler.**
Les régions comprises entre la Haute-Sanga, le Chari et le Cameroun. Par le Capt. Lœfler. *Map.*

Kamerun. *M. Deuts. Schutzgebieten* **21** (1908): 157–162, 189–199. **Hassert and Thorbecke.**
Bericht über die landeskundliche Expedition der Herren Prof. Dr. K. Hassert und Prof. Dr. F. Thorbecke in Kamerun. *Maps.*
These papers have been referred to in vol. **32**, p. 530; vol. **33**, p. 328.

Kamerun—Communications. *Deutsches Kolonialblatt* **19** (1908): 999–1004. **Stein.**
Ein grosse Verkehrsstrasse von Duala nach der Ostgrenze Kameruns. Von Hauptmann Freiherrn v. Stein. *Map.*
Shows how a line of communication might be supplied by the navigable waterways, linked together by lines of railway.

Mauritius—Meteorology, Etc. ———
Results of the magnetical and meteorological observations made at the Royal Alfred Observatory, Mauritius, in the year 1906, under the direction of T. F. Claxton. London, 1908. Size 12 × 10, pp. 6, xxx., and lxxvi. *Diagrams. Presented by the Observatory.*

Morocco. *Renseignements Col., Com. Afrique française* **17** (1907): 209–224. **Weisgerber.**
Les Chaouia. Par le Dr. F. Weisgerber. *Sketch-maps and Illustrations.*

Nile. *Cairo Sc. J.* **2** (1908): 242–244. **Craig.**
The relation between Nile floods and atmospheric pressure. By J. J. Craig.

Portuguese East Africa. **Vasse.**
Guillaume Vasse. Trois années de chasse au Mozambique. Paris: Hachette et Cie., 1909 [1908]. Size 7½ × 5, pp. 192. *Sketch-map and Illustrations. Price* 4 *fr.*
The author's routes extended over the region on both sides of the Beira railway. Sport forms the main subject of the volume.

NORTH AMERICA.

Canada—Minerals. **Tyrrell.**
Minerals and Ores of Northern Canada. By J. B. Tyrrell. (From the Canadian Mining Institute, Part of vol. **11**.) Size 8½ × 6, pp. 47–68. *Illustrations. Presented by the Author.*

Canada—Surveys. ———
Department of the Interior. Annual Report of the Topographical Surveys Branch, 1906–1907. Ottawa, 1908. Size 10 × 6½, pp. iv. and 352. *Maps and Diagram.*
Includes various special reports by surveyors, dealing with exploratory work, base-line measurement, and so forth (see March number, p. 330).

Niagara. *Science* **28** (1908): 754–759. **Spencer.**
Side issues bearing on the age of Niagara Falls. By J. W. Spencer.

North America—Historical. *Monthly Weather Rev.* **36** (1908): 169–173. **Lacy.**
Some climatic influences in American history. By Walter N. Lacy.

United States—Hudson River. *American J. Sci.* **26** (1908): 301–323. **Kemp.**
Buried Channels beneath the Hudson and its Tributaries. By J. F. Kemp. *Sketch-map and Sections.*

United States—Maryland. ———
Maryland Geological Survey. Vol. **6**. Baltimore: Johns Hopkins Press, 1906. Size 10½ × 7, pp. 578. *Map and Illustrations.*

United States—Maryland. ———
Maryland Weather Service. Vol. **2**. Baltimore: Johns Hopkins Press, 1907. Size 10½ × 7, pp. 516. *Maps, Illustrations, and Diagrams.*

United States—Missouri. *Scottish G. Mag.* **24** (1908): 588–596. **Owen.**
The Missouri River and its Future Importance to the Nations of Europe. By Luella A. Owen.

United States—Relief. *J.G.* **6** (1908): 337–347. **Sutherland.**
Physiography of the Gulf coastal plain. By W. J. Sutherland.

CENTRAL AND SOUTH AMERICA.

Chile—Strait of Magellan. **Pacheco.**
Derrotero del Estrecho de Magallanes i aguas adyacentes, de la Bahia Inútil i Seno Almirantazgo, de los Senos Otway i Skyring, i del Golfo Xaultegua. Redacto . . . por Baldomero Pacheco. Valparaiso, 1908. Size $9\frac{1}{2} \times 6\frac{1}{2}$, pp. xiv. and 328. *Chart and Illustrations.*

Panama—Canal. *Petermanns M.* **54** (1908): 171–177. **Regel.**
Zur Panamakanalfrage. Von Prof. Dr. Fr. Regel. *Maps and Section.*

Panama—Meteorology. *Monthly Weather Rev.* 163–165. **Abbot.**
Progressive climatic variations on the isthmus of Panama. By Brig.-General Henry L. Abbot. *Diagram.*

Venezuela—Cartography.
Memoria que dirige al Congreso Nacional de los Estados Unidos de Venezuela el Ministro de Guerra y Marina en 1907. Tomo II. Trabajos del Cuerpo de Ingenieros encargado del levantamiento del Plano Militar de Venezuela. Caracas (1908). Size $12 \times 8\frac{1}{2}$, xxiv. and 384. *Maps.*

AUSTRALASIA AND PACIFIC ISLANDS.

New Guinea—German—New Mecklenburg. **Schlaginhaufen.**
M. Deuts. Schutzgebieten **21** (1908): 213–220.
Orientierungsmärsche an der Ostküste von Süd-Neu-Mecklenburg. Von Dr. Otto Schlaginhaufen. *Maps and Illustrations.*

New Guinea—German—Tanga. *Globus* **94** (1908): 165–169. **Schlaginhaufen.**
Ein Besuch auf den Tanga-Inseln. (Von der Deutschen Marine-Expedition, 1907–09.) Von Dr. Otto Schlaginhaufen. *Sketch-maps and Illustrations.*
Small islands lying east of New Mecklenburg.

New Zealand—Geology. *T. and P. New Zealand I.* **40** (1907): 78–98. **Marshall.**
Geology of the centre and north of North Island. By P. Marshall. *Geological Map.*

New Zealand—Glaciers. *J. T. Victoria I.* **40** (1908): 104–114. **Fox.**
On the glaciers, past and present, in the South Island of New Zealand, together with the great vertical movements of the ground. By C. Dillworth Fox.

New Zealand—Mount Hector. *T. and P. New Zealand I.* **40** (1907): 289–304. **Petrie**
Account of a Visit to Mount Hector, a high peak of the Tararuas, with a List of Flowering Plants. By D. Petrie.

New Zealand—Valley Terraces. *T. and P. New Zealand I.* **40** (1907): 16–43. **Speight.**
Some Aspects of the Terrace-development in the Valleys of the Canterbury Rivers. By R. Speight. *Sketch-map and Illustrations.*

MATHEMATICAL GEOGRAPHY.

Navigation. *Nautical Mag.* **80** (1908): 471–377. **Goodwin.**
The new lunar and its limits of accuracy. By H. B. Goodwin. *Diagram.*

Surveying—Photographic. *R. Engineers J.* **8** (1908): 217–230. **Thompson.**
Stereoscopic photography applied to reconnaissance and rapid surveys. By Captain F. V. Thompson. *Diagrams and Illustrations.*

Time. *Cairo Sc. J.* **2** (1908): 220–234. **Wade and Craig.**
The determination of local time in sub-tropical latitudes. By E. B. H. Wade and J. I. Craig.

PHYSICAL AND BIOLOGICAL GEOGRAPHY.

Limnology—Instrument. **Garwood.**

Note on a new sounding machine for use on lakes and rivers without a boat. By E. J. Garwood. (From the *Proceedings of the Royal Society*, A., vol. **81**, 1908.) Size 10 × 7, pp. 243–249. *Illustrations.*

Noticed in the Monthly Record (vol. **32**, p. 535).

Meteorology—Historical. *Quart. J.R. Meteorol. S.* **34** (1908): 221–232. **Hellmann.**

The dawn of meteorology. By Dr. G. Hellmann. *Illustrations.*

A lecture delivered before the Meteorological Society in March, 1908.

Oceanography—Atlantic. *Mem. on Hydrography* **28** (1907): 134–148. **Sovyetof.**

The periodic changes in the Gulf Stream and the surrounding waters. By S. Sovyetof. *Sketch-chart and diagrams.* [In Russian.]

Oceanography—Currents. *Ann. Hydrographie* **36** (1908): 447–450. **Mohn.**

Einige Bemerkungen über den Einfluss der Erdrotation auf die Meeresströmungen. Von H. Mohn.

Oceanography—Currents. **Pettersson.**

Ueber Meeresströmungen. Von Prof. Dr. Otto Pettersson. (Veröffentlichungen des Instituts für Meereskunde und des Geographischen Instituts an der Universität Berlin, herausgegeben von A. Penck; Heft 12.) Berlin: E. S. Mittler u. S., 1908. Size 10½ × 7, pp. 68. *Maps, illustrations, and diagrams.*

Oceanography—Currents. *Ann. Hydrographie* **31** (1908): 429–446. **Schiötz.**

Bemerkungen über die durch den Wind erzeugten Meeresströmungen. Von O. E. Schiötz.

Oceanography—Pacific. **Findlay and Kettle.**

A supplement to the third edition of Findlay's Sailing Directory for the North Pacific ocean and Japan, with revised descriptions of the coasts, islands, etc. By W. R. Kettle. London: Imray, Laurie, Norie, & Wilson. 1908. Size 10 × 6, pp. 272. *Presented by the Compiler.*

Seismology. *C.R.A. Sc., Paris* **167** (1908): 655–656. **Montessus de Ballore.**

Variations de latitude et tremblements de terre. Note de [F.] de Montessus de Ballore.

Seismology. *Beiträge Geophysik* **9** (1908): 237–377. **Tams.**

Geographische Verbreitung und erdwissenschaftliche Bedeutung der aus den Erdbebenbeobachtungen des Jahres 1903 sich ergebenden Epizentren. Von Ernst Tams. *Map.*

Tides. **Platania.**

Giovanni Platania. Nuove ricerche sulle librazioni del mare. (Estratto dall' Annuario del R. Istituto Nautico 'Duca degli Abruzzi' di Catania, vol. **1**, Anno 1907.) Catania, 1907. Size 9 × 6, pp. 20. *Diagrams.*

Tides. **Ruthven.**

Moxly's theory of the tides. By J. F. Ruthven. London: J. D. Potter. 1908. Size 9½ × 6, pp. 36. *Diagrams. Price* 2*s. Presented by the Publisher.*

An endeavour "to explain in popular language Moxly's new equilibrium theory of the tides, which is a reversion to the original theory" of Sir Isaac Newton, with an important addition or correction.

BIOGRAPHY.

Évreux. **Marcel.**

Le père Yves d'Évreux. Par Gabriel Marcel. (Extrait du *Journal de la Société des Américanistes de Paris*, tome **4**, No. 2.) Paris, 1908. Size 11 × 7, pp. 12.

The subject of this notice was a missionary in Brazil in the early part of the seventeenth century (see March number, p. 334).

Lindeman. *Deutsche G. Blätter* **31** (1908): 246–252. **Wolkenhauer.**

Dr. Moritz Lindeman. Von W. Wolkenhauer.

This well-known geographer, whose varied interests included in particular nautical affairs and polar exploration, died in August last, aged eighty-five.

Logan. **Bell.**

Sir William E. Logan and the Geological Survey of Canada. By Dr. Robert Bell. Ottawa, [1908]. Size 8½ × 5½, pp. 28. *Portrait.*

GENERAL.

Geography—General Treatise. **Scobel.**

Geographisches Handbuch: allgemeine Erdkunde; Länderkunde und Wirtschaftsgeographie. Herausgegeben von Albert Scobel. Fünfte . . . Auflage; Erster Band. Bielefeld u. Leipzig: Velhagen & Klasing, 1909. Size 10½ × 7, pp. xvi. and 958. *Sketch-maps, Illustrations. Price* 12*m. Presented by the Publishers.*

Place-names—Orthography. *G.Z.* **14** (1908): 403–406. **Köppen.**

Ueber die Schreibung geographischer Namen. Von W. Köppen.

Recalls suggestions made by the writer in 1893, with modifications to bring them into accord with recent developments.

Place-names—Orthography. **Ricchieri and others.**

Quali siano le difficoltà principali per un accordo internazionale sulla scrittura e sulla pronuncia dei nomi geografici e in qual modo si possano superare. Relazione presentata al ix. Congresso Internazionale di Geografia (Ginevra, 1908) dal Prof. Giuseppe Ricchieri, anche a nome dei Professori G. G. Chisholm, H. Cordier, et R. Sieger. Milan, 1908. Size 9½ × 6½, pp. 16.

Scientific Papers. **Galton.**

Suggestions for improving the literary style of scientific memoirs. By Francis Galton. (Reprinted from the *Transactions of the Royal Society of Literature*, vol. **28**, Part 2.) London, 1908. Size 8½ × 5½, pp. 18.

NEW MAPS.

By E. A. REEVES, *Map Curator,* **R.G.S.**

EUROPE.

Austria—Vienna. **Artaria.**

Plan von Wien. Scale 1: 25,000 or 2·5 inches to 1 stat. mile. Vienna: Artaria & Co., 1909. *Price* 2.40 *kr. Presented by the Publishers.*

Austria-Hungary. **Freytag.**

G. Freytag's Verkehrs-Karte von Österreich-Ungarn, 1909. Scale 1: 1,500,000 or 1 inch to 23·7 stat. miles. Vienna: G. Freytag & Berndt, 1909. *Price* 2*kr. Presented by the Publishers.*

Austria-Hungary. **Rothaug.**

Karte der Königreiche Ungarn und Galizien und des Herzogtums Bukowina. Bearbeitet von J. G. Rothaug. Scale 1: 2,500,000 or 1 inch to 39·5 stat. miles. Vienna: G. Freytag & Berndt, [1909]. *Presented by the Publishers.*

On this map relief is shown by lightly printed hill shading, upon which is superimposed an effectively arranged series of colour tints on the prismatic or "stereoscopic" principle. The higher lands are specially well brought out.

Belgium. **Institut Cartographique Militaire.**

Carte de Belgique. Scale 1: 100,000 or 1 inch to 1·6 stat. mile. Sheets: 13, Tournai; 14, Mons; 15, Charleroi; 16, Namur; 17, Liége; 18, Roisin; 19, Thuin; 20, Dinant; 21, Laroche; 22, Cul-des-Sarts; 23, Bouillon; 24, Arlon; 25, Villers-devant-Orval; 26, Virton. Brussels: Institut Cartographique Militaire, 1908.

These are the first sheets of a new map of Belgium now in course of publication,

and which, when complete, will consist altogether of twenty-six sheets, each measuring 17 inches by 20 inches. It is printed in colours, and shows relief by contour-lines, in brown, at 10-metre intervals.

British Isles. **Johnston.**

Bathy-Orographical Map of the British Isles. Scale 1 : 875,000 or 1 inch to 14 stat. miles. With Handbook. Edinburgh: W. & A. K. Johnston, Ltd., 1909. *Price* 12*s. mounted on rollers and varnished. Presented by the Publishers.*

A good general map of the British Isles for school use. It shows heights of land in tints of brown only, and depths of water in shades of blue. The names of the various orographical features are according to the system approved by this Society. The map is clearly drawn and printed, and is mounted on rollers.

British Isles—England and Wales. **Ordnance Survey.**

Sheets published by the Director-General of the Ordnance Survey, Southampton, from February 1 to 28, 1909.

4 miles to 1 inch (Revised Second Edition):—

In outline, 3. 1*s.* 6*d.* (engraved).

2 miles to 1 inch:—

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1 : 2500 Scale—County Maps:—

Cheshire (Second Revision), XLIV. 2, 4, 5, 6, 7, 10, 13. 3*s. each;* XLIV. 8. 1*s.* 6*d.* **Hampshire** (Second Revision), LXVII. 11, 14; LXXIII. 3, 6, 7, 8, 9, 12; LXXIV. 1, 5, 7, 9, 11, 16; LXXV. 3, 4, 7, 8; LXXVI. 1, 7, 11; LXXVIII. 8, 12; LXXIX. 6, 9, 10, 13; LXXX. 4, 8, 12; LXXXI. 1, 5; LXXXII. (1 and 2), 4; LXXXVII. 2. 3*s. each.* **Kent** (Second Revision), III*a.* 13; IX. 15; X. 6, 7, 9, 11, 12, 16; XII. 5, 9; XVI. 12; XVII. 3, 4, 6; XVIII. 1, 4, 8, 12; XIX. 1, 5, 9; XXXIX. 7, 11, 12, 14, 15, 16; XL. 13; XLI. 2, 11; XLII. 5; XLIX. 1, 3, 14, 15; L. 1, 13, 14; LIX. 4, 7; LX. 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12; LXI. 1, 5. 3*s. each.* **Lancashire** (First Revision of 1891 Survey), LXXXV. 11, 12, 16; LXXXVI. 11, 12, 15, 16; XCIV. 3, 4; CV. 5, 10. 3*s. each.* **Yorkshire** (First Revision of 1891 Survey), CXLIX. 3, 7, 8, 10, 12, 15, 16; CLXVI. 3, 10, 12, 13, 14, 16; CLXVII. 1, 2, 5, 6, 9, 10, 11; CLXVIII. 10, 11, 14, 15, 16; CLXIX. 4, 5, 9, 11, 13, 15, 16; CLXX. 9, 11, 13, 14; CLXXXII. 3; CLXXXIII. 8, 12; CLXXXIV. 1; CLXXXV. 2, 4; CLXXXVI. 8, 10; CLXXXVII. 1, 2, 3, 4; CLXXXIX. 6, 11, 12, 14, 15, 16; CXC. 2, 3, 4. 3*s. each.*

(*E. Stanford, London Agent.*)

England and Wales. **Geological Survey.**

1-inch map.

New series, colour-printed. Drift Edition, 34, 53, 65. *Price* 1*s.* 6*d. each.*

6-inch Maps (Quarter sheets, uncoloured):—

Carmarthenshire, 47 S.E. *Price* 1*s.* 6*d.*

(*E. Stanford, London Agent.*)

British Isles—Irish Channel. **Philip.**

Philips' Ocean Travellers Series. Irish Channel. Scale 1 : 1,500,000 or 1 inch to 23·6 stat. miles. London: George Philip & Son, Ltd., [1909]. *Price* 5*s. net. Presented by the Publisher.*

A useful little pocket chart of the Irish channel, showing steamer lines with duration

of voyage, cables, lighthouses, railways, and information likely to be serviceable to travellers. Ten plans of ports and harbours, on enlarged scales, are given as insets. The chart is taken from that given in Philips' Mercantile Marine Atlas, with additions.

Europe. **Bartholomew.**

Bartholomew's Contour Motoring Map of Central Europe, showing the best touring roads, with heights and distances in metres and kilometres. Scale 1 : 2,000,000 or 1 inch to 31·6 stat. miles. Edinburgh : John Bartholomew & Co., 1909. *Price* 5*s. net dissected on cloth.*

Although on too small a scale to give much detail, this map should be useful to motorists for general reference. It is orographically coloured, and shows the height of land by tints of green and brown. The area included extends from the west of England and France to Buda-Pest, and from the Baltic to the Mediterranean coasts.

France. **Service Géographique de l'Armée, Paris.**

Carte de France. Scale 1 : 50,000 or 1·3 inch to 1 stat. mile. Sheets : XXXIV.-16, Bayon ; XXXV.-16, Lunéville. Paris : Service Géographique de l'Armée, 1908. *Price* 1.60 *fr. each sheet*

Two sheets of the new 1 : 50,000 map of France, which was noticed in the *Geographical Journal* for February, 1907.

France. **Ministre de l'Intérieur, Paris.**

Carte de la France dressée par ordre au Ministre de l'Intérieur. Scale 1 : 100,000 or 1 inch to 1·6 stat. mile. Sheets : VI.-15, Quintin ; VII.-18, Questembert ; XV.-8, Abbeville (Ouest) ; XVI.-9, Amiens ; XVIII.-13, Meaux ; XVIII.-28, St. Flour ; XX.-28, Le Puy ; XX.-35, Pointe de l'Espiguette ; XXII.-27, La Côte St. André ; XXII.-28, St. Marcellin ; XXII.-31, Nyons ; XXIII.-25, Belley ; XXIV.-14, Nancy ; XXV.-35, Lorgues. Paris : Ministère de l'Interieur, Service Vicinal, 1908. *Price* 0.80 *fr. each sheet.*

These are new editions.

Germany. **K. Pruess, Landesaufnahme.**

Karte des Deutschen Reiches. Scale 1 : 100,000 or 1 inch to 1·6 stat. mile. Sheets : (Kupferdruck-Ausgabe) 445, Zittau ; 446, Hirschfelde. (Buntdruck-Ausgabe) 342, Luckau ; 344, Guben ; 364, Zörbig ; 366, Torgau ; 367, Finsterwalde ; 368, Calau. (Umdruck-Ausgabe) 637, Landsberg. Berlin : K. Preuss. Landesaufnahme, 1908.

Switzerland. **Abteilung für Landestopographie, Bern.**

Topographischer Atlas der Schweiz (Siegfried Atlas). Scale 1 : 25,000 or 2·5 inches to 1 stat. mile. Sheets : 252, Weesen ; 228, La Muratte ; 296, Thierrens ; 326, Lully ; 329, Düdingen ; 363, Charmey ; 364, Schwarzsee ; 376, Pilatus ; 377, Stans ; 434, Bière ; 437, Morges ; 459, Dent de Brenleire ; 484, Lavey-Morcles.— Scale 1 : 50,000 or 1·3 inch to 1 stat. mile. Sheets : 351 bis, Gurnigel ; 405, Laax ; 409, Hanz ; 417 bis, Martinsbruck ; 425 bis, Glurns ; 482, Sierre ; 486, Sion ; 487 ; Vissoye ; 493, Aletschgletscher ; 514, Locarno ; 520, Maloja ; 523, Castasegna. Bern : Abteilung für Landestopographie, 1906-08. *Price* 1 *fr. each sheet.*

These are new editions, with the exception of No. 484, which is a new sheet.

Switzerland. **Schweizerische Geologische Kommission.**

Geologische Karte der Schweiz herausgegeben von der Geologischen Kommission der Schweizer. Naturforschenden Gesellschaft auf Kosten der Eidgenossenschaft. Specialkarte No. 45, Geologische Karte der Umgebung von Aarau aufgenommen 1866-1907 von Prof. Dr. F. Mühlberg (dazu ein Heft Erläuterungen No. 8). Scale 1 : 25,000 or 2·5 inches to 1 stat. mile. Specialkarte No. 49, Geologische Karte des Blauenberges südlich Basel aufgenommen 1904 und 1905 von Dr. Ed. Greppin (dazu ein Heft Erläuterungen No. 7). Scale 1 : 25,000 or 2·5 inches to 1 stat. mile. Specialkarte No. 52, Carte geologique du Massif de la Dent Blanche (moitie septentrionale), levé geologique par Emile Argand 1905-1907. Scale 1 : 50,000 or 1·3 inch to 1 stat. mile. Zürich : Schweizerische Geologische Kommission, 1908. *Presented by the Swiss Geological Commission.*

Turkey. **Geographical Section, General Staff.**

Map of Turkey. Scale 1 : 250,000 or 1 inch to 3·9 stat. miles. Sheets : Adrianople, Constantinople, Ismid, Jumaa-i-Bala, Rodosto, Vize. London : Geographical Section, General Staff, War Office, 1909. *Price* 2*s.* 6*d. net each sheet. Presented by the Director of Military Operations.*

ASIA.

Asia Minor. **Herzfeld.**

Reiseroute in West Cilicien (südl. Kleinasien) März-Juni 1907. Nach eigenen aufnahmen von Dr. Ernst Herzfeld. Scale 1 : 300,000 or 1 inch to 4·7 stat. miles. *Petermanns Mitteilungen*, Jahrgang 1909, Tafel 3. Gotha: Justus Perthes, 1909. *Presented by the Publisher.*

Shows Dr. Ernst Herzfeld's route survey from the railway at Eregli, south-east across the Taurus, through the Cilician Gates to Tarsus, thence westward along the coast to Selefkie, then north-west through Mut to the railway at Karaman. Considerable detailed information is given along the route concerning the natural features of the country and archæology. The map accompanies Dr. Herzfeld's account of journey in *Petermanns Mitteilungen* for February last.

Caucasia. **Stieler.**

Gebirgskarte von Kaukasien aus Stieler's Handatlas. Scale 1 : 3,700,000 or 1 inch to 58·4 stat. miles. *Petermanns Mitteilungen*, Jahrgang 1909, Tafel 4. Gotha: Justus Perthes, 1909. *Presented by the Publisher.*

This is a print in brown of the map of Caucasia from Stieler's Hand-Atlas, showing mountains only in vertical hachures. No names appear on the map itself, but those of the leading ranges are given on a sheet of tracing-paper which is placed over the map. The map has been specially arranged to illustrate a paper on the geomorphology of the Caucasus by Prof. Dr. Karl Oestreich, in *Petermanns Geograph. Mitteilungen* for February last.

Japan. **Imperial Geological Survey, Tokyo.**

Topographical map of Japan. Scale 1 : 200,000 or 1 inch to 3·2 stat. miles. Sheet: Iki. Tokyo: Imperial Geological Survey, 1908. *Presented by the Imperial Geological Survey of Japan.*

Philippine Islands—Luzon. **Department of the Interior, Manila.**

Map of the Mancayan-Suyoc, Lepanto Province. Topography by Maurice Goodman and Harry M. Ickis, Field Assistants; A. J. Eveland, Geologist in charge. Scale 1 : 4800 or 13·2 inches to 1 stat. mile. Manila: Department of the Interior, Mining Bureau, 1904.

AFRICA.

Algeria. **Service des Cartes et Plans, Alger.**

Carte des Voies de Communication au Departement de Constantine. Dressée par ordre de M. C. Jonnart, Gouverneur-Général. Scale 1 : 400,000 or 1 inch to 6·3 stat. miles. Algiers: Service des Cartes et Plans. Gouvernement Général de l'Algérie, 1908. *Presented by M. René de Flotte Roqueraire, Chef du Service des Cartes et Plans.*

One of the series of maps now being published by the Algerian Government to show means of communication. Railways and various kinds of roads are distinguished by different symbols and colours. It is an outline map only, without hills.

Morocco. **Larras.**

Cartes de reconnaissance du Maroc levées et dessinées par le Capitaine N. Larras, 1898–1906. Scale 1 : 250,000 or 1 inch to 3·9 stat. miles. Sheet: Marrakech. Paris: Henry Barrère, [1909].

Shows the country in the neighbourhood of Marrakech, except on the north-west part of the sheet, which is occupied by an inset plan of the city of Marrakech on the scale of 1 : 25,000.

Tunis. **Service Géographique de l'Armée, Paris.**

Carte de la Tunisie. Scale 1 : 100,000 or 1 inch to 1·6 stat. mile. Sheet: XC. Tamezret. Paris: Service Géographique de l'Armée, [1909]. *Price* 1.20 *fr. each sheet.*

AMERICA.

Canada. **Department of the Interior, Ottawa.**

Sectional map of Canada. Scale 1 : 190,080 or 1 inch to 3 stat. miles. Sheets: 19, Willowbunch, revised to June 25, 1908; 21, Turtle mountain, revised to July 16, 1908; 64, Porcupine, revised to June 23, 1908; 72, Portage la Prairie, revised to July 24, 1908; 116, Rainy Hills, revised to August 14, 1908; 118, Rush Lake, revised to June 17, 1908; 318, Shell River, revised to September 12, 1908; 319,

Prince Albert North, revised to August 21, 1908. Ottawa: Department of the Interior, Topographical Surveys Branch, 1908. *Presented by the Department of the Interior, Ottawa.*

South America. **Johnston.**

Bathy-orographical map of South America. Scale 1 : 6,150,000 or 1 inch to 84·2 stat. miles. Edinburgh: W. & A. K. Johnston, Ltd., 1909. *Price, mounted on rollers and varnished,* 12*s.* *Presented by the Publishers.*

A boldly drawn map of South America, showing heights of land and depths of water by shades of colour. The land relief is given in tints of green and brown, of which there are seven, and the water by four shades of blue. The map is on rollers, varnished, and is intended for school use.

South America. **Meiklejohn and Holden.**

Meiklejohn's Series of Oroscopic Maps. No. 1, South America. [Scale 1 : 3,750,000 or 1 inch to 59·2 stat. miles.] London: Meiklejohn & Holden, 1909. *Price* 6*s. net. Presented by the Publishers.*

PACIFIC OCEAN.

Fiji Islands. **Lands Department, Fiji.**

Fiji Islands. Compiled and drawn at the Lands Department, Suva, Fiji. Scale 1 : 380,160 or 1 inch to 6 stat. miles. Suva, Fiji: Lands Department, 1908. *Presented by the Crown Agents for the Colonies.*

A good general map of the Fiji islands on a sufficiently large scale to be really useful for reference. Owing to the fact that only the crests of the principal mountains and hills, with their heights, are given, the map is clear, but does not give an idea of the general relief of the islands. It is printed in colours, and shows, amongst other information, telegraph and telephone lines, provincial boundaries, towns and villages, railways, roads, paths, cables, lighthouses, places where steamers call, sugar mills, and hospitals.

GENERAL.

World. **Vidal-Lablache.**

Atlas général Vidal-Lablache: Histoire et Géographie. 420 Cartes et Cartons: Index alphabetique de 46,000 noms. Livraisons 7 and 8. Paris: Armand Colin, 1909. *Price* 1.10 *fr. net each part.*

The following maps are contained in these parts:—Part 7: No. 15, Italie Ancienne, partie méridionale; 16 and 17, Conquêts Romaines; 18, Gaul au temps de César; 81, Colonies Françaises; 81*a* and 81*b*, Algérie; 81*c*, Tunisie. Part 9: No. 18*a*, Germanie Ancienne; 18*b* and 18*c*, État Économique du Monde Ancien au II^e^ siècle de l'ère Chrêtienne; 18*d*, Expansion du Christianisme jusqu'à la fin du XIV^e^ siècle; 122*a*, Carte Géologique de l'Inde; 122*b* and 122*c*, Empire Chinois; 122*d*, Empire du Japon.

CHARTS.

Admiralty Charts. **Hydrographic Department, Admiralty.**

Charts and Plans published by the Hydrographic Department, Admiralty, during January, 1909. *Presented by the Hydrographer, Admiralty.*

New Charts.

No.	Inches.	
X. 17	— —	Speed, time, and distance diagram. 2*s.*
3724 m	= 14·8	Plans in the Firth of Forth:—Granton harbour. 2*s.*
633 m	= var.	Plans on the north and east coasts of Ireland:—Drogheda entrance, Skerries islands, Rogerstown inlet, Culdaff bay, Malahide inlet, Ardglass harbour, Killough harbour. 3*s.*
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Charts Cancelled.

No.	Cancelled by	No.
633 Harbours and anchorages on the east coast of Ireland:—Malahide inlet, Rogerstown inlet, Skerries, Drogheda entrance, Ardglass harbour, Killough bay and harbour, Culdaff bay.	New chart. Plans on the north and east coasts of Ireland:—Drogheda entrance, Skerries islands, Rogerstown inlet, Culdaff bay, Malahide inlet, Ardglass harbour, Killough harbour	633
2325 Denmark:—Lim fiord.	New chart. Lim fiord, including Mariager and Randers fiords. Plans:—Nykiöbing, Hobro, Hadsund, Lemvig, Struer, Lögstör, Glyngöre Skive, Lim fiord (eastern entrance), Thisted, Aalborg, Mariager fiord entrance, Randers fiord entrance, Randers .	2325
689 Gibraltar harbour.	New chart. Gibraltar harbour	689
55 Anchorages in New Britain, New Ireland, and New Guinea:—Plan of Namalili anchorage on this sheet.	New chart. Gazelle peninsula and St. George's channel	3553

New Editions.

No. 2631*a*, England, south coast:—Portsmouth harbour, upper part. 1951, England, west coast:—Liverpool bay. 2497, Scotland, west coast:—Loch Hourn. 2551, Scotland, west coast:—Isle of Skye. 1185, England, east coast:—River Thames, sea reach. 3191, England, east coast:—River Thames, Woolwich to Erith. 1481, Scotland, east coast:—River Tay. 2339, North sea, general sheet. 3465, Denmark:—Trælle nes to Aarö sund. 1939, Greece, west coast:—Dragamesti bay and approaches. 232*b*, Newfoundland island, sheet ii. 284, Newfoundland:—Cow head harbour to St. Genevieve bay. 1177, Newfoundland:—Savage island anchorage and Old port au choix. 1677, Newfoundland:—St. Margaret bay and Castors harbour. 2320, Nova Scotia:—Approach to Halifax. 311, Nova Scotia:—Halifax harbour. 1923*a*, British Columbia:—Cape Caution to Point Simpson. 2453, British Columbia:—Brown and Edye passages. 654, Alaska, Bering strait. 1231, Alaska:—Plans on the western shore of Bering sea. 593, Alaska:—Yukon river to Point Barrow. 3660, Gulf of Aden:—Aden harbour. 1654, Island of Java, eastern portion.

Indian Ocean and Red Sea. **Meteorological Office.**

Monthly meteorological charts of the Indian Ocean north of 15° S. lat. and Red Sea, March, 1909. London: Meteorological Office, 1909. *Price 6d. each. Presented by the Meteorological Office.*

Liverpool Bay. **Belam.**

Liverpool Bay. Surveyed by the Marine Surveyor of the Mersey Docks and Harbour Board. Scale 1:36,000 or 1·7 inch to 1 stat. mile. Liverpool: Mersey Docks and Harbour Board, 1908. *Presented by H. G. G. Ashton, Esq., Assistant Marine Surveyor, Mersey Docks and Harbour Board.*

This is a new edition.

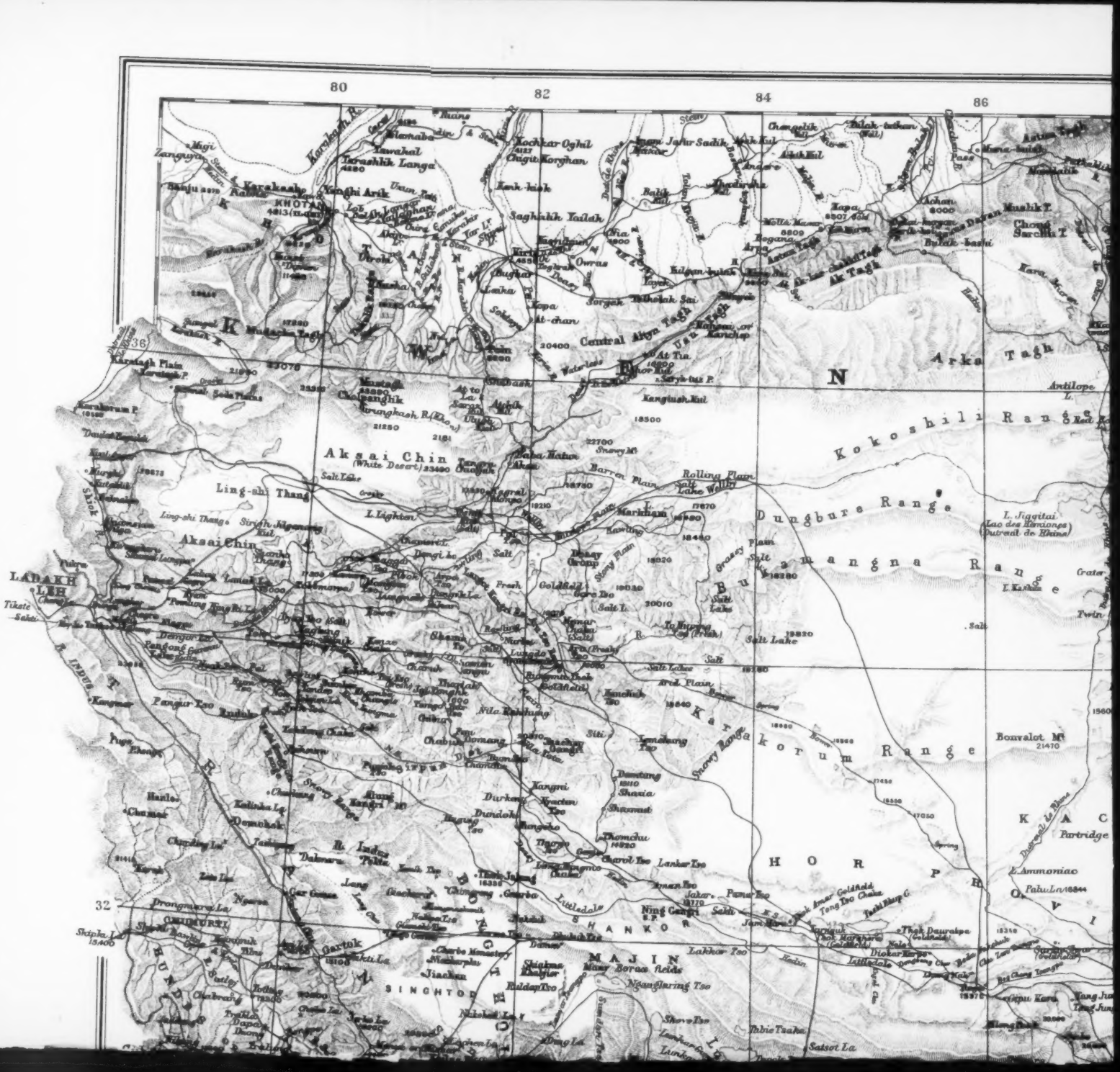
North Atlantic and Mediterranean. **Meteorological Office.**

Monthly meteorological charts of the North Atlantic and Mediterranean, March, 1909. London: Meteorological Office, 1909. *Price 6d. each. Presented by the Meteorological Office.*

North Pacific. **U.S. Hydrographic Office.**

Pilot chart of the North Pacific Ocean, March, 1909. Washington: U.S. Hydrographic Office, 1909. *Presented by the U.S. Hydrographic Office.*

N.B.—It would greatly add to the value of the collection of Photographs which has been established in the Map Room, if all the Fellows of the Society who have taken photographs during their travels, would forward copies of them to the Map Curator, by whom they will be acknowledged. Should the donor have purchased the photographs, it will be useful for reference if the name of the photographer and his address are given.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Aksai Chin
(White Desert)
Ling-shi Thang
Aksai Chin
LADAKH
LEH
Kokoshili Range
Dungbure Range
Bu2mangna Range
Karakorum Range
Arka Tagh
Central Altyn Tagh
Snowy Range
HORPO
MAJIN
SHANKOR
SINGHTOR
CHUMURTI
KHOTAN
Bonvalot Mt
21470
Partridge
Antilope
L. Jiggitai
(Lac des Hirondelles)
(Dutreuil de Rhins)
L. Lighten
L. Markham
Salt Lake
Salt Lakes
Snowy Mt.
Grassy Plain
Barren Plain
Rolling Plain
Salt Lake Valley
Bare Plain
Arid Plain
Stony Plain
Stony Flats
Sand Hills
Sandy Plain
Karatagh Plain
Kangtush Kul
Aksai Kul
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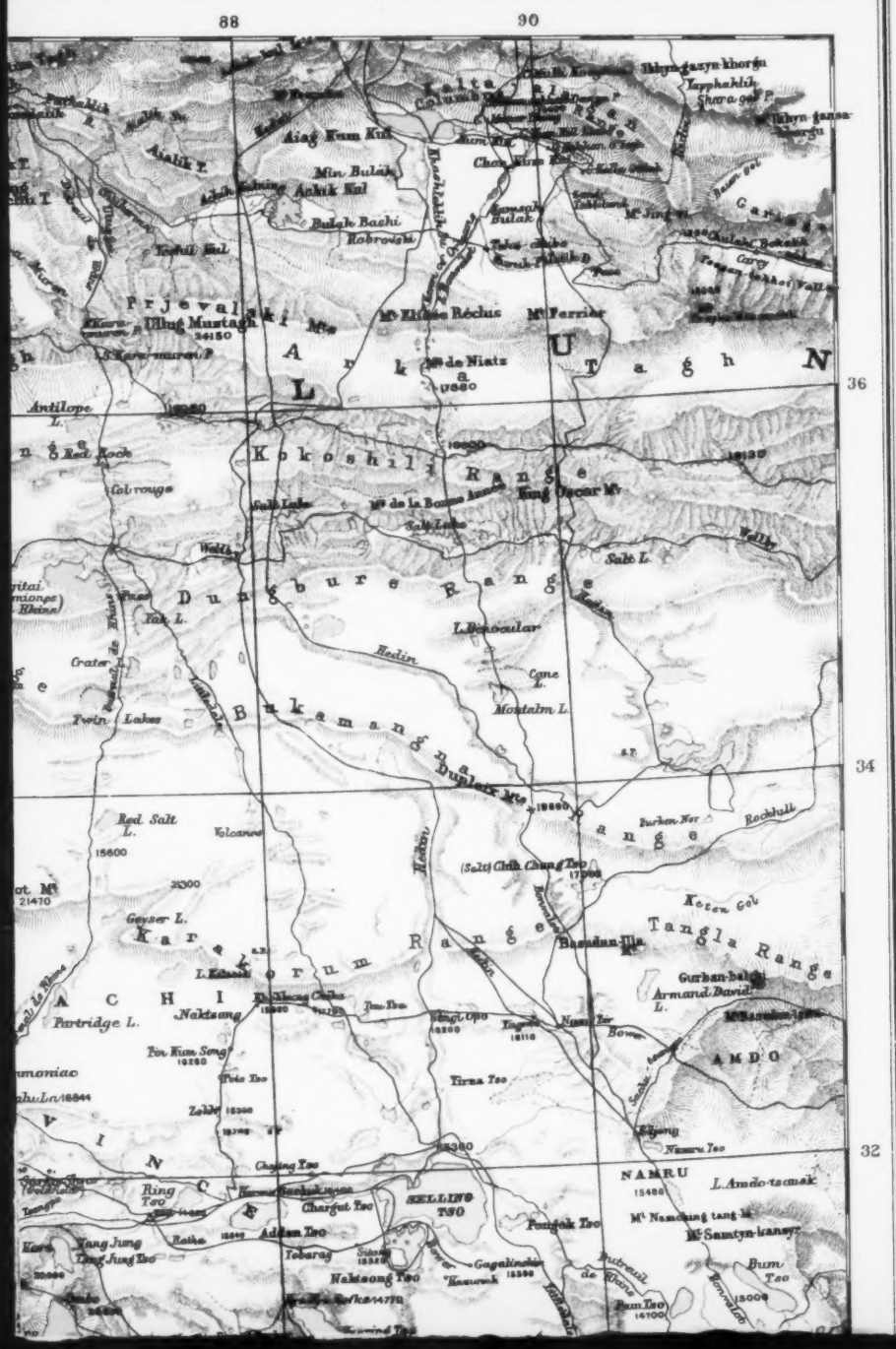
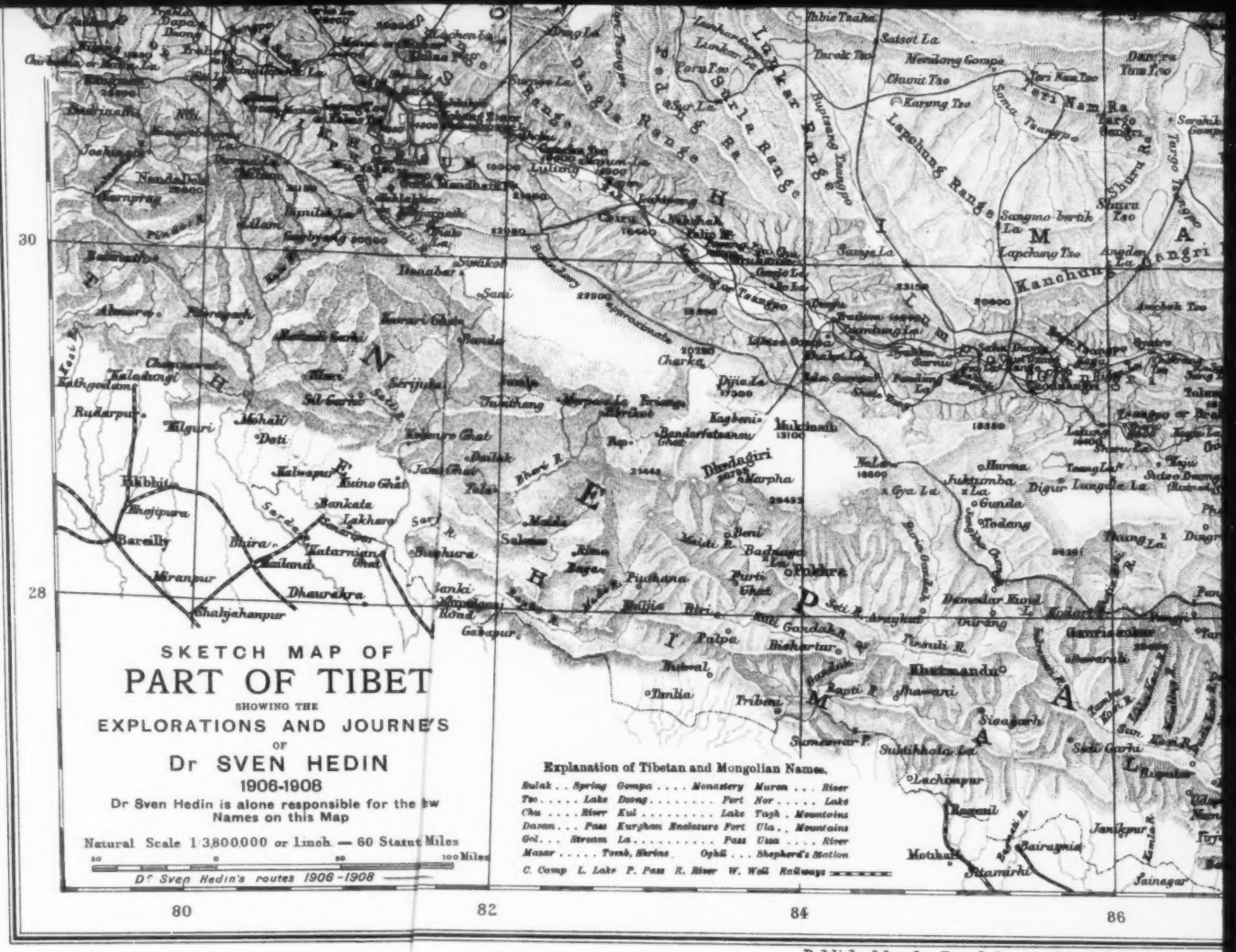
THE GEOGRAPHICAL JOURNAL 1909




SKETCH MAP OF
PART OF TIBET
SHOWING THE
EXPLORATIONS AND JOURNEYS
OF
Dr SVEN HEDIN
1906-1908
Dr Sven Hedin is alone responsible for the spelling of Names on this Map
Natural Scale 1:3,800000 or 1 inch. — 60 Statute Miles
Dr Sven Hedin's routes 1906-1908
Explanation of Tibetan and Mongolian Names.
Bulak . . Spring Gompa . . . . Monastery Muren . . . River
Tso . . . . . Lake Dzong . . . . . Fort Nor . . . . . Lake
Chu . . . . River Kuti . . . . . Lake Tagh . Mountains
Davan . . . Pass Kurghan Enclosure Fort Ula . . Mountains
Gol . . . Stream La . . . . . Pass Usu . . . . River
Mazar . . . . . Tomb, Shrine Ogha . . . Shepherd's Station
C. Camp L. Lake P. Pass R. River W. Well Railways
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